THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XIX. No. 460—22ND YEAR.] LONDON, MAY 24, 1870. [Subscription per Annum. 15s. in Advance. 18s. Credit.] Price 8d. Unstamped.

RAMSAY'S NEWCASTLE CANNEL
COAL. Analysis—
10,000 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1828.
FIRE-BRICK WORKS, established 1804.
FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay.
The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article.
The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.
These Meters are warranted to measure correctly and not to vary, and have come into general use more rapidly than any Meters hitherto manufactured.

PARIS EXHIBITION, 1867.
THE TESTING-HOUSE REPORTS.
The Reports prepared for the Science and Art Department, under the direction of the Lords of the Council, detail the arrangements made for testing the gas apparatus exhibited. In the testing-house erected by the Special Committee appointed to further this object a gasholder was constructed by Mr. G. Glover, being a *fac simile* of that produced and patented by him in 1860, and deposited in the Exchequer, under the provisions of the Sales of Gas Act, and British manufacturers of gas apparatus were invited by advertisement, and by direct application, to forward worthy objects for exhibition. Mr. G. Glover was, however, the only manufacturer who sent Meters to be tested. The report states that, as "Mr. Glover is a manufacturer of Dry Meters only, no opportunity presented itself of comparing their accuracy with that of Wet Meters under various circumstances, but the perfection to which that maker has brought his Meters prevents the possibility of those extravagant errors which are well known to exist where Wet Meters are used."
Particulars and lists of prices forwarded on application to Ranelagh Works, Ranelagh Road, Pimlico, LONDON, S.W.; 15, Market Street, MANCHESTER; or 127, Boulevard de Magenta, PARIS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.
JOHN RUSSELL and CO.,
THE OLD TUBE-WORKS,
CHURCH HILL, WEDNESBURY;
ALMA WORKS,
WALSALL, STAFFORDSHIRE;
and 69, UPPER THAMES STREET, LONDON,
Original Manufacturers of Wrought-Iron Gas-Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam-Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest orders may be executed in a few days.
Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanized Tubes, &c.
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AND
STREET-LAMP
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NEAR NEWCASTLE-ON-TYNE.
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GEORGE GLOVER AND CO.,
Patentees of the Standard Gasometers for the Government,
TWO MEDALS,

LONDON, 1862.
HAVE OBTAINED THE
HIGHEST
PRIZE
FOR
SILVER MEDAL,

PARIS, 1867.
IMPROVED DRY GAS-METERS AND GASOMETERS,
AT THE
PARIS EXHIBITION.
RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.
AND 127, BOULEVARD DE MAGENTA, PARIS.

JOURNAL OF GAS LIGHTING ONE PENNY NEWSPAPER

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Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

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SILVER MEDAL, PARIS EXHIBITION, 1867.

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For Gas, Steam, Water, &c.

SOLE LICENSEES for the United Kingdom for the LAVENANT PATENT ENAMELLED TUBES & FITTINGS,

the Coating of which does not shell off, is a certain preservative from rust, and resists all effects of expansion and contraction.

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For Locomotive, Marine, and Stationary Boilers.

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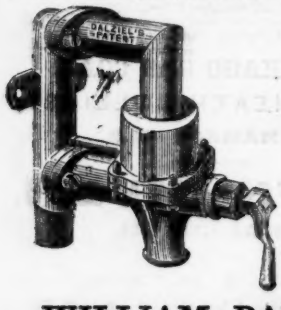

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The only Prize Medal awarded for TUBES & FITTINGS.

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Of the Best Material and Workmanship, carefully adjusted to the requirements of the British Sales of Gas Act and Foreign Standards of Measures.

PATENT COMPENSATING GAS-METERS,

Which are uniform with the Ordinary Meters, and register with minute accuracy.

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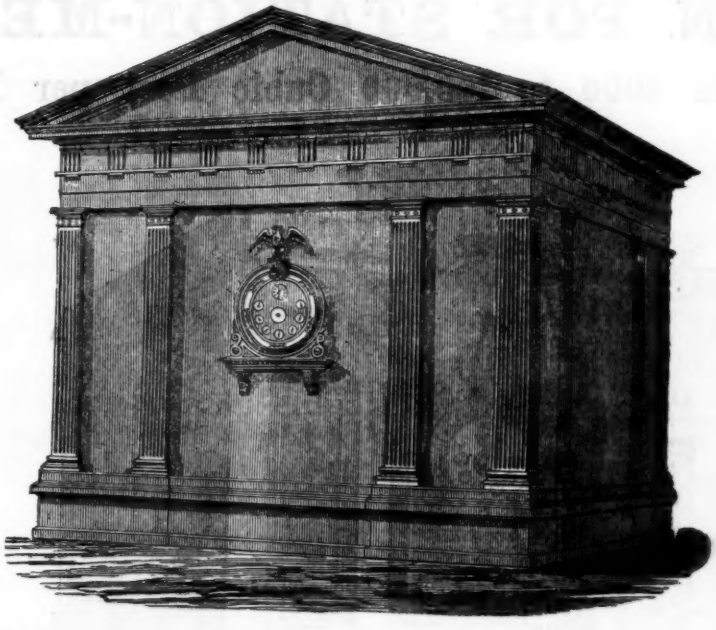

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Tender their grateful acknowledgments for the past generous and extensive patronage conferred on their firm, and beg to assure their Friends, Gas Engineers, and Gas Companies generally, that every exertion will continue to be made to maintain the sterling quality of their work in every department.

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All sizes of CONSUMERS METERS generally in Stock.

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Possess a simplicity of construction and facility for repair greater than any yet produced, while the excellence of the material and workmanship, and accuracy of registration, cannot be surpassed. The superiority of their Dry Meters in Tin Cases is also well known, having stood the test of years.

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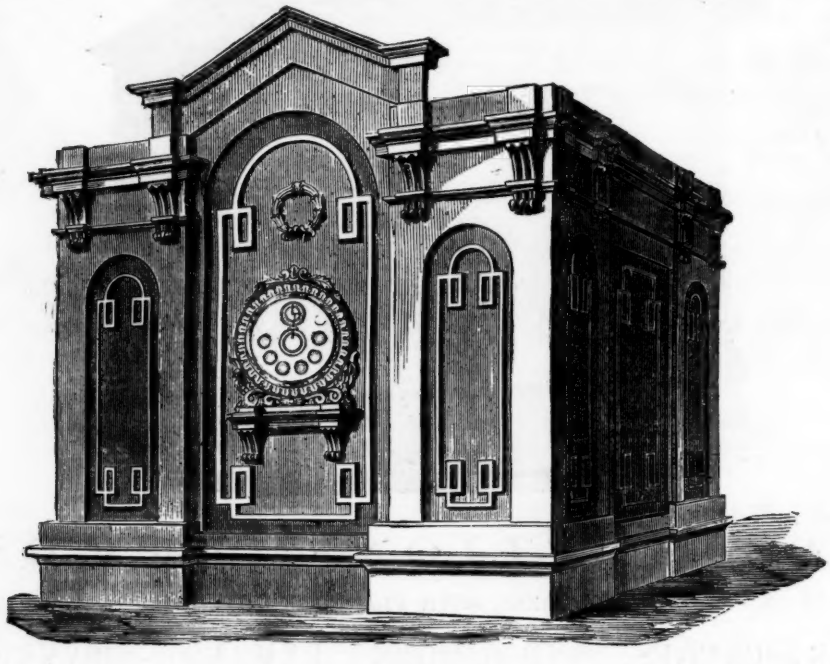

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Meters of a similar design may be seen in operation in London, Manchester, Liverpool, Dublin, Oldham, Leeds, Bristol, Halifax, Salford, Stockport, Wolverhampton, Rochdale, Bradford, Bolton, Blackburn, and many other places.

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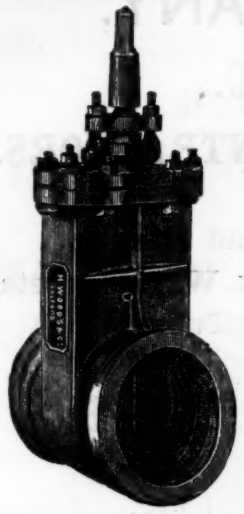
As supplied to Water-Works and Local Boards.



SLUICE-VALVES, from 14s. per inch,

Tight on both Faces, and fitted with Gun-Metal Valve Faces and Seats, and Screws and Nuts.

Every Valve proved to 200 lbs. per square inch.

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HYDRANTS,
WITH
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Valves, and Nuts,
18s. each.

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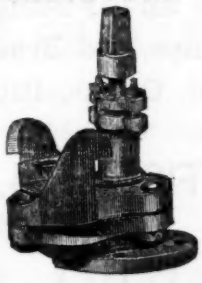

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GREAT ECONOMY IN GAS-MAKING.

This Generator is charged with Coal by gravity, direct from waggons. The Coke is extracted with a minimum of labour. Fifty per cent. of labour saved, and all distressing labour obviated. Gas of high illuminating power, and desulphurized Coke of great density, suitable for metallurgical purposes.

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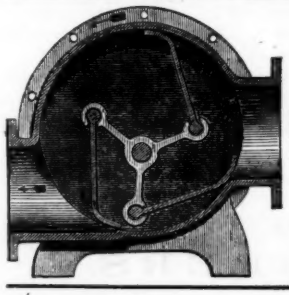
HICKMOTT'S PATENT METHOD OF LAYING WROUGHT-IRON SERVICE-PIPES,
Whereby they are rendered everlasting. For particulars, apply to the above address.



CHARLES HORSLEY'S

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(From 250 Feet upwards per Hour.)

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For particulars and prices apply to the Patentee,

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Are Durable, Economical, and keep their Colour.

See "The Record of Engineering," 1864.
"The Journal of the Society of Arts," June 1, 1866.
"The Mechanics' Magazine," October 26, 1866.
"The Engineer," November 2, 1866.

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For ensuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.

CATHELS'S Patent Ribbed Gas Main-PIPES cost but about 1d. to 2d. per yard (depending on the size) more than Plain Pipes, and ensure PERFECT GAS-TIGHT CONNEXIONS with the Service-Pipes.

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For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

TO GAS COMPANIES & OTHERS.

THE PATENT ANTI-GALVANIC PAINT

Is recommended to all intending to Paint their Gasholders, Purifiers, &c., this season, as the most valuable PRESERVATIVE PAINT. It prevents and arrests all rust, will cover tar, will stand heat, and is not acted on by any gaseous exhalations. It is made ready for use.

For price, &c., apply to BRACE, BRACE, AND CO., 11, Red Lion Court, Fleet Street, LONDON, E.C.

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Established 1840.

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OF EVERY DESCRIPTION.

Orders of any magnitude, for home and exportation, executed with all possible despatch.

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Circulars, 15 in. and 16 in. Ovals, 20 in. by 14 in.

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STANSTEAD GAS-WORKS, HERTS.

MESSRS. BENINGFIELD & CO. are instructed by the Mortgagees to SELL BY AUCTION, on TUESDAY, May 24, 1870, at Two for Three o'clock, at the Corn Exchange, Ware, Herts, all that valuable property known as the

STANSTEAD GAS-WORKS,

with newly-erected Retort-house, with retorts, Condensers, Coal-shed, Purifying-house, Workshop, a Gas-meter, all the Main and Service Pipes, Meters, Public Lamps, &c.

The works are in full operation, and offer an excellent opportunity to a practical gas proprietor, or for a profitable investment, there being great scope for extending the consumption of gas in the neighbourhood.

Particulars may be had, 14 days previous to the Sale, of Messrs. TODD AND SON, Solicitors, HULL; of Messrs. FURBER, PRICE, AND FURBER, Warwick Court, Holborn, LONDON; and of the AUCTIONEERS, Ware, HERTS, and Waltham Abbey, ESSEX.

LA MUNICIPALITE DE GALATZ donne avis:

Qu'en exécution d'une partie du système des travaux d'amélioration projetés, elle met en adjudication

LA CONCESSION

DE L'ECLAIRAGE AU GAZ ET AU PETROLE DE LA VILLE DE GALATZ.

Le concours aura lieu par offres cachetés, sur la base du cahier des charges apprové par le gouvernement roumain.

Le jour fixé pour le concours sera

JEUDI LE 30 JUIN, 1870, NOUV. STYLE.

Le cahier des charges, une esquisse du plan de la ville et les conditions du concours, seront à la disposition de ceux qui en feront la demande, à partir du 1er Mai prochain, et leur seront expédiés à l'adresse qu'ils indiqueront.

Les demandes devront être adressées par lettres affranchies au

MAIRE DE LA VILLE,
GALATZ, ROUMANIE.

CARRICK-ON-SUIR GAS-WORKS, COUNTY TIPPERARY, IRELAND.

THE Directors of the Carrick-on-Suir Gas Company, Limited, are prepared to receive TENDERS for the LEASE of the above WORKS.

Tenancy to commence October 1st, 1870.

Tenders to be lodged with the undersigned on or before the 1st of June 1870.

For further particulars, apply to J. ERNEST GRUER, Secretary, CARRICK-ON-SUIR.

March 9, 1870.

ALFRED PENNY, Gas and Consulting ENGINEER,

WENLOCK IRON-WORKS,

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Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, and T-pieces, &c., &c.

Plans, Specifications, and Estimates prepared.

D. GRANT & CO.,

GAS-METER MANUFACTURERS.

STATION-METERS ANY SIZE,

PHOTOMETERS, EXPERIMENTAL METERS, &c.

GAS-METER WORKS, CROSSCAUSEWAY, EDINBURGH.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & Co., GHENT, will receive immediate attention.

THOMAS CARR & SON,

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FIRE-BRICKS, LUMPS, TILES, RETORTS,

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SCOTSWOOD FIRE-BRICK WORKS,

NEAR

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EDGE'S Patent for Removing the CARBONACEOUS INCRUSTATION from GAS-RETORTS.

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IMPROVED

WOOD SIEVES FOR GAS PURIFIERS.

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The above Sieves are used by the principal Gas Companies in London and the country. Their utility, durability, and cheapness combined, render them superior to all others.

Testimonials from Gas Engineers who have tested their qualities forwarded on application.

All orders punctually attended to, and estimates given if required.

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GAS AND WATER ENGINEERS AND CONTRACTORS.

WHOLESALE DEALERS IN

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NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

Analyses by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

Description.	Cubic Feet of Gas per Ton of Coals.	Illuminating Power in Candles.	Coke per Ton of Coal used. Cwt.	Ash in Coke per Cent.	Sulphur in Coal per Cent.
Best Silkstone . .	10,900	17·0	12·8	2·6	1·7
Norfolk Silkstone . .	11,000	15·94	12·5	4·4	1·64
Silkstone Brights . .	11,500	14·5	12·6	7·4	1·85
Silkstone Nuts . .	10,800	15·85	12·66	6·0	0·69

NOTE.—The illuminating power of the Gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

FULLERTON, SON, & CO.,

GAS-METER MANUFACTURERS,

LONDON ROAD METER-WORKS EDINBURGH,

SOLE MANUFACTURERS OF

THE PATENT IMPROVED TIN-PLATE DRY METER,

WITH SPECIAL FACILITIES FOR ADJUSTING AND REPAIR,

The principal parts of the mechanism being accessible by the removal of a single screw.

GAS-METERS on the WET and DRY principles made in CAST-IRON and TIN-PLATE CASES.

STATION-METERS, GOVERNORS, EXPERIMENTAL & TEST METERS, GAS APPARATUS, &c.

LONDON AGENTS: THORNELOE & CO., 34, London Wall, City, E.C.,

Where Meters are supplied to order from Stock.

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large Stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all Sizes kept in London at Mr. ALFRED WILLIAMS, Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—*Export orders continue to have prompt attention.*

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And BIRMINGHAM (TANGYE BROTHERS), CORNWALL WORKS, SOHO.

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS.

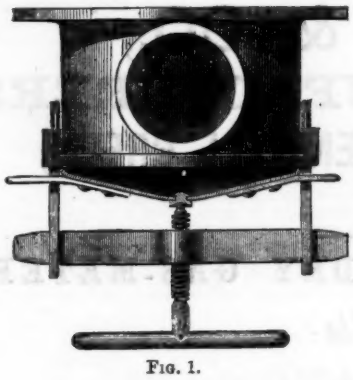

FIG. 1.

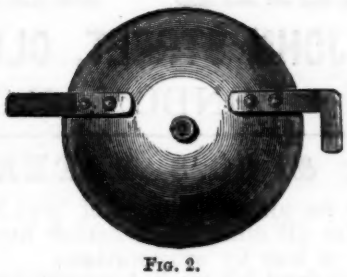

FIG. 2.

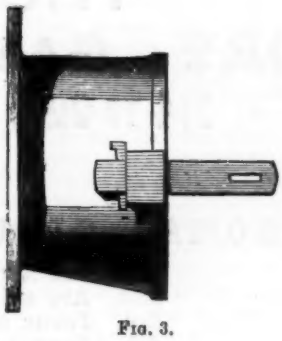

FIG. 3.

Several Hundreds in successful operation in various Gas-Works.

The expensive and cumbersome process of sealing the mouths of Gas-Retorts by means of luting the Lids with lime and other materials hitherto used for that purpose, is henceforth rendered unnecessary, and will be superseded by the very efficient method shown in the accompanying illustrations.

Fig. 1 shows a plan of a mouthpiece with Morton's Patent Lid in section. The mouthpiece is faced true, and the projecting circular edge or periphery of the lid is also turned true, and, by preference, of a semicircular section, so that the point of contact is reduced to a minimum; the convex form of the Lid rigidly sustains the force of the screw, which, by its central action, gives the Lid a uniform bearing, and effectually seals the mouth of the Retort.

Fig. 2 shows a front view of Morton's Patent Lid, which is stamped out of plate iron, having (in this case) ledges to rest on the lugs of the mouthpiece; these Lids, however, are more generally fitted to hinged cross-bars, by which means they remain suspended while the charge is withdrawn and the Retort charged, so that the damage done by throwing them about is entirely prevented.

The advantages obtained are—

1st. The sound sealing of the Retort during the whole time it is carbonizing the charge of coal, there being no jointing medium between the Lid and the mouthpiece.
2nd. The improved condition of the coke by the non-mixture of lime.
3rd. The Lid requires no preparation on the part of the stoker, beyond slightly scraping the surface to remove extraneous grit or dirt.
4th. The Lids are only about two-thirds the weight of the old form in general use, a Lid for a 16-inch mouthpiece weighing a little over 20 lbs.
5th. The Self-sealing Lid reduces labour, saves wear and tear, obviates all the inconvenience and discomfort consequent on the preparation of luting, and effects a great reduction in the working expenses. The cost attending the process of "luting" in several large gas-works, exceeds £1000 per annum, ranging in various works from 20s. to 35s. per mouthpiece.

It will be obvious that a round Lid is the most convenient and the cheapest form. D Retorts are adapted for round Lids, by carrying the bottoms down the necessary depth for that purpose, as shown in Fig 3. Some mouthpieces have been thus adapted, and are in use at the Chartered Gas-Works.

The following testimony speaks in favourable terms after ample and careful test:—

Burslem and Tunstall Gas Company, Longport, Staffordshire, Oct. 12, 1869.

Dear Sir,—In reply to your favour of the 9th inst., I have pleasure in stating that my admiration for your Patent Retort-Lid is most unqualified. I have 14 of them in use, and have tested them in the severest manner possible at these works, but without being able to detect the slightest defect. Yesterday the strap slipped off the exhauster, and a pressure of 13 inches was thus almost instantly thrown upon the Retorts, but although many of the luted Lids were leaking, not the slightest escape was observable from yours. I had anticipated that at least some greater degree of care would have been required in the scraping of the mouthpieces after the drawing of each charge, but even in this particular I find that labour has been reduced.

By every stoker on these works, as well as by myself, your Lids are regarded as a boon.

Please send me 30 more at your earliest convenience.

I am, &c., (Signed) HENRY WOODALL.

R. Morton, Esq.

Chartered Gas Company, Horseferry Road, Westminster, Sept. 15, 1869.

Dear Sir,—I have only lately returned to town, which is the reason I have not replied earlier to your inquiry.

I beg to say that I have had your Lids in use for upwards of two months, and during that time they have always kept a perfectly sound joint. I may add that where your lids are used only one set is required.

I remain, &c., (Signed) G. O. TREWBY.

R. Morton, Esq.

Chartered Gas Company, 146, Goswell Street, E.C., Oct. 20, 1869.

Dear Sir,—I have much pleasure in stating that, after some months trial of your Retort-Lids, I find them everything I could desire. I consider the plan a great improvement.

I am, dear sir, yours truly, (Signed) A. UPWARD.

R. Morton, Esq., London Gas Company.

These Lids are in successful use at the London Gas-Works, the Chartered Gas-Works, the Dublin Gas-Works, the Buralem and other Works, giving great satisfaction.

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Sole Makers of Upward's Patent Safety Drilling Apparatus, Weston's Patent Differential Pulley Blocks, the "Special Steam-Pump," the Patent Duplex Lever Punch, &c.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

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THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

PATENT WET AND DRY GAS-METER MANUFACTURERS, &c., &c.,

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

PATENT IMPROVED WET METER.

W. P. and Co. invite especial attention to this Meter, which entirely overcomes the difficulty to which ordinary Wet Meters are subjected, owing to the short range of the Float, which is necessary, in order to meet the requirements of the Sales of Gas Act.

"It is well known that in Meters constructed so that the valve will close when the water is drawn off to such a point as to render them 3 per cent. slow, the lights are liable to be extinguished by the closing of the valve by a sudden increase of pressure. To meet this difficulty, Mr. Pinchbeck has invented an ingenious and simple arrangement by which the action is reversed, and any such increase of pressure, in his Meter, raises the valve instead of depressing it. The fact of the improvement having been adopted by Messrs. W. Parkinson and Co. is a sufficient guarantee that it practically and effectually remedies the inconvenience it is designed to meet."—JOURNAL OF GAS LIGHTING.

PATENT IMPROVED DRY METER,

Which W. P. and Co. pledge themselves to manufacture with the same quality of materials and workmanship as in their Wet Meter, thereby giving Gas Companies and others the advantage of procuring a first-rate Dry as well as a Wet Meter, which, hitherto, they have been unable to do.

STATION-METERS AND GOVERNORS,

Which can be seen at all the London Gas-Works; also at Liverpool, Manchester, Sheffield, Nottingham, Belfast, Glasgow, Birmingham, Dublin, Bristol, Leeds, Leicester, Brighton, Southampton, Sunderland, Wolverhampton, Bradford, Norwich, &c., &c.

TEST GASHOLDERS, EXPERIMENTAL METERS, EXHAUSTER REGULATORS,

MINUTE CLOCKS, PRESSURE GAUGES, PHOTOMETERS, PRESSURE REGISTERS, &c.

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TO CORRESPONDENTS.

H. C.—*We are not acquainted with any formula applicable to such a case as you inquire about, or of any attempt to separate gas lost by condensate from loss by leakage, stealage, or any of the other causes that contribute to make up the item of gas unaccounted for.*

NOTICES.

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THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 24, 1870.

Notes upon Passing Events.

THE lively debate which took place in the House of Commons on the case of Mr. Edward Barry's dismissal by Mr. Ayrton, turned partly on a question of manners, but chiefly on a question of customs, which interests every one who has built or has to keep an important edifice in repair. Mr. Ayrton, the First Commissioner of Works, is equally well known as a man of extraordinary ability and offensive manners. Whether on social or on political matters, he is about as disagreeable a personage as any official could have over him, or any dinner guest could have opposite him. Having, as he boasts, not passed through any public school or university, where clever men are apt to have insolence and bumptiousness taken out of them, in his early life he was always cock of the walk. He spent the first half of his public career in acquiring a competent fortune as an attorney at Bombay, where a naturally overbearing disposition was cultivated by contact with the servile native population. Returning to Europe, he proceeded seriously to educate himself for the duties of a Member of Parliament and legislator, with above average success. An excellent speaker, with considerable administrative powers, he made himself so disagreeable on the independent bench of Liberals, that the Government were glad to muzzle him by putting him in the Treasury. There, although useful, he made himself so offensive to his colleagues and the high-class gentlemen who were his subordinates, that they were delighted when the promotion of Mr. Layard to the Embassy at Madrid facilitated Mr. Ayrton's removal to a post where, at any rate, he had fewer colleagues to snub, and where, although he boasted of contempt for painting, sculpture, and "*the beautiful*" in general, there was an Augean mass of administrative disorder for the exercise of his Herculean powers. One of his steps was to appoint a permanent officer of works, to control the constant repairs and additions which the Palace of Westminster requires. Perhaps he could not have taken a wiser step, or selected a more fit person for the post than Captain Galton. The next was to come into collision with Mr. Edward Barry, who had succeeded to the nominal or honorary post of architect, held by his father. Mr. Barry is an architect of the first class. Successive Commissioners of Works bear testimony not only to his taste and skill, but to the unusual merit of his work, which never once exceeded his estimates during the time he had been employed on the Westminster Palace—or premises, as Mr. Alderman Lawrence rather professionally and unluckily called them in his short, excellent, and successful speech. In the course of the correspondence between Mr. Ayrton and Mr. Barry, the former called upon the latter to give up the plans and drawings from which the Houses of Parliament have been erected. Mr. Barry, under very excusable irritation, refused; and now the Institution of British Architects has taken up the case, and laid down, as their law and custom, that architects have a right to retain the drawings and plans of buildings they erect, after they have been paid the usual commission of 5 per cent. We will not enter into the question of law, as that is doubtful. Certain it is that, in cases of dispute about an architect's remuneration, the delivering up the drawings and plans is the usual basis of a compromise. We do not dispute that the architects as a body claim to retain the originals, and only supply copies at the cost of the client; but we assert that this is a custom which ought to be strenuously resisted by both public and private bodies, as utterly opposed to common sense and equity. We have at this moment an instance before us of an architect most properly dismissed from the control of a public building, who, having retained the custody of important drawings after his own estimate of his claims had been discharged, now holds his special knowledge as an instrument to compel his re-employment. Not that this was Mr. Barry's case; and, as Mr. Alderman Lawrence exceedingly well put it, "a gentleman known by almost every member of the House, highly esteemed by his professional brethren, received a letter which no gentleman would send to a butler who had been thirty years in his employment. It was as if Mr. Ayrton had said to his butler, 'Send me a list of the plate, and I will see if it is satisfactory. Deliver up your keys, and I will tell you what I intend to do.' If Mr. Barry had been written to in a gentlemanly manner, the difficulty would never have arisen." We are sorry that Mr. Barry's feelings have been hurt. We trust we shall not lose his intelligent services in making the House of Parliament more useful for business than it is at present; but we are glad that a vote of the House of Commons has answered the unreasonable claim of the architects to keep "the cake" for which they have been paid. It is not a little odd how completely the constitution of the Ministry contradicts the vulgar idea that pride, insolence, and frigidity are the peculiar attributes of the aristocracy. The Earl of Clarendon, the Earl Granville, are models of courtesy and kindness. Public school and university training have given manners, if not geniality, to our unaristocratic Chancellor of the Exchequer. We must go the Board of Works to find an example of the "'aughty noble" of the Victoria Theatre, in a Bombay attorney. Since writing the preceding "Notes," Mr. Ayrton has surpassed himself in his own peculiar line, as the most disagreeable, the most cantankerous member of Mr. Gladstone's Government. Mr. Beresford Hope made a very fair, and not in the least offensive, speech, the text of which was simply "An additional or new National Gallery is urgently required; when are you going to commence either one or the other?" Nothing would have been easier for any gentleman accustomed to parlia-

mentary debates to reply in a satisfying way, without pinning himself to any particular date, but for Mr. Ayrton that was quite impossible. Coldly and spitefully sarcastic, he took the line of that Irishwoman who used to be one of the stock figures in the Bishop of Winchester's comic speeches when he was Bishop of Oxford, and had to please ladies by being funny. Being asked for the loan of a washing-tub by a small child-messenger—we will not attempt the bishop's Irish brogue—she replies, "Tell "your mother it's lost—I can't find it; the staves are loose—"the bottom's out." The child being supposed to still stop and stare, "Don't you see, you little baste, I'm using it myself?" It is very hard that the Prime Minister, in addition to his own work, has continually to start up, like the commanding officer of a regiment, to support the authority of one of his drill-sergeants.

There is a great likeness in the official part of the Barry and the Boxer case. In both, the principle for which the head of the Government department contended was right; but it is quite clear that Sir John Pakington muddled his instructions, and led Colonel Boxer to believe (quite unintentionally) that he was (happy patentee!) at liberty to make the most of the Government and the public. However, the late Colonel, now Major-General Boxer, has no substantial grievance against the nation, whatever he may have against Sir John Pakington. On the contrary, he has been a most fortunate man. His ingenuity and mechanical skill are above average, no doubt, but not greater than that of hundreds of inventors and patentees, like poor Snider, who have worn out their hearts before they could get—if ever—a substantial reward for, or even a public recognition of, their inventions. Take the case of the Boxer cartridge, for instance. The original Boxer cartridge was of paper, protected from the weather by a sort of varnish, that proved a failure under Indian heat. Mr. Daw invented and patented a metal cartridge-case, and submitted it to the War Department. Straightway Colonel Boxer, to whom it was referred, invented (?) another metal cartridge-case, folded in a way which the law authorities held not to be an infringement of Mr. Daw's patent; and this cartridge, having been approved by the superintendent of the laboratory at Woolwich—*i. e.*, Colonel Boxer himself—became the cartridge of the British army, and the subject of a royalty to Colonel Boxer. Colonel Boxer being the authority to designate the firms to supply his patent cartridges, of course named the assignees of his patent, Messrs. Eley. This is enough, without the additional charges which Messrs. Kynoch and Co. made in the columns of the *Times*. The nation and Parliament have reason to be satisfied with Mr. Cardwell for putting an end to a system under which "articles designed by the com-"bined skill of Government workers and officers (and also of "private inventors), brought out at public expense, were patented "by the head of the department, the same head having the privi-"lege of selecting the contractors who shall manufacture his "patent articles for Government use" at a price approved or settled by him. We are not prepared to agree with Messrs. Kynoch and Co. that Government manufactories should be suppressed. They should exist, but only for the purpose of giving full trials to the inventive genius of the age, and stimulating private enterprise. The Birmingham manufacturers were as much behind the age as old Woolwich, until stirred up by American competition and the Enfield Factory. It is the character of all great manufacturing establishments, whether private or public, to fall into routine after a long course of the monopoly obtained by well-deserved success. No more striking example could be given than that of the old firm of Boulton and Watt, which died out from lack of invention and enterprise.

The Institution of Civil Engineers have very judiciously, and with extraordinary promptitude, published a report of the speeches at the annual dinner, which took place early in this month. The dinner was distinguished not only by the rank and intellectual distinction of the guests, but by the strictly professional tone of the speeches; in this respect, being in strong and advantageous contrast to the orations at the dinners of many societies, where the special objects of the association seem too often lost in the sauce of flattery with which illustrious and aristocratic guests are besmeared. Her Majesty's Ministers, Her Majesty's Opposition, the Church, the Bench, and the Bar, were not less powerfully represented than the Army, the Navy, and, wonderful to say, than Science. Some really good things were said; for instance, Earl Granville, without flattery, described civil engineers as, "like a Government," requiring "a knowledge of organiza-"tion, of administration, and of executive duties; and, like a "Government, a knowledge of men. They not only require, but "I am afraid they possess, a greater knowledge of things "than some of the most eminent statesmen could pretend "to." The Earl of Derby took the opportunity of defending the Institution, of which "accident and the constitution of the coun-"try have made me a member," and he rather happily described the House of Lords as a "jury selected at random from the edu-"cated classes," but including "some in this room now who have "made public affairs and political studies a life-long occupa-"tion." He also alluded gracefully to the noble names associated with our great industries. "You cannot deliver a lecture "on the steam-engine in which the name of Lord Worcester "shall not be mentioned; you can hardly tell the story of the "iron industry of this country without some reference to the "family of Dudley; and you cannot speak of inland navigation "without giving his due to that Duke of Bridgwater to whom is "mainly due the development of the canal system, and the pre-"sent position which Manchester and Liverpool now hold." He might have added that the three noble families of Sutherland, Ellesmere, and Brownlow are branches of the family and share the fortunes of the canal-making Duke of Bridgwater. Lord Derby, after referring to Belper, a cotton lord, and Wolverton, a railway bank lord, concluded by hoping that, "in the "interest of the next generation, in the interest of the House of "Lords rather than of the engineering profession, which is well "able to take care of itself, the next generation would see the "honours of the peerage considerably extended amongst those "who are the representatives of the industrial interests of the "country." No wonder that this peroration met with "great "applause" in an assembly which naturally foresaw, among the grandsons of guests, "Honourable Hawkshaws, Fowlers, and Bidders," with others, in the words of the old Eton Grammar, "*quos nomi-"nare longum est.*" The Solicitor-General, as likely a man as any of the guests to wear a coronet, praised the House of Commons, not unduly, as "a place where real weight of character and "high honour, or simple honesty, have full authority, and super-"ficial cleverness and a facile power of talking very little." Chief Justice Bovill, who took the place of Lord Chief Justice Cockburn, absent through illness, was not very happy in a set speech proposing the toast of "Prosperity to the Institution of Civil "Engineers, and with it Mr. Bidder," except where he expressed a wish that some of the energy of the civil engineering profession "could be devoted to the machinery of the State, and especially "to the machinery of the law." Mr. Bidder, in replying, was in his best mood. With the exception of Baron Charles Dupin and two others, he was the oldest member of the Institution, having been on its rolls for forty-five years. "I was not one of the "thirteen founders, who held their first meeting at a barber's "shop, but I was one of those who met in Buckingham Street, "Strand, and afterwards in Cannon Row—not more dignified, "but more commodious—and I moved with it to Great George "Street, our present site, where we eked out our means by let-"ting lodgings. I have, therefore, some right to consider myself "a link between the old and new school of engineers. We now "inhabit an almost palatial building of our own. We have paid "for it; we are not in debt; we have neither debenture nor pre-"ference stock. Our growth, from a few members numbered by "tens, to seventeen hundred, beside an affiliated class of students, "is due to the essentially democratic character of our profession. "We have not been fostered or nourished by official care; we "have each depended on our own energies; we have had first to "battle with material nature and its forces, and then to do battle "with our fellow-men." Mr. Bidder, with a great deal of point, added: "I make these observations because there is a feeling in "high quarters that an engineer can be made by colleges and "examinations—as it were by machinery. Some persons think "that what is called *technical* education will make an engineer. "A sound knowledge of mathematics, of chemistry, of geology, "is of great value in our profession; but to imagine that a book "knowledge of them will make an engineer is as absurd as to "imagine that books, without the conflict of the courts, will make "such a Chief Justice and such a Solicitor-General as have ad-"dressed you." The Archbishop of York, in reply, said: "Technical education on a sound basis is necessary for preventing "waste of time and power, and placing our young engineer on a "ground of advantage for commencing a contest with the powers "of nature, which is to be his whole career." The sentence "sound basis" brings the two speakers into agreement. Mr. Fowler, in proposing the toast of "Literature, Science, and Art," coupled with it the names of Sir Francis Head, Professor Tyndall, and Mr. Beresford Hope—a curious Trinity. He made an elaborate speech, which appears not to have received applause in proportion to the trouble it must have cost the speaker to prepare. Diplomacy and engineering are more his *forte* than oratory. He made, however, one good professional point when he entreated Mr. Beresford Hope "to use his great influence to induce the "authorities of London to undertake street and architectural im-"provements in connexion with engineering works, and, by judi-"cious liberality and co-operation on their part, secure results "satisfactory to art and utility;" which means, we presume, to unite projects for much-needed new thoroughfares with underground railways—a very sound suggestion. An example of the advantages to be derived from the union of railways with street extensions was presented last Friday, when a powerful deputation,

headed by the two members for Westminster, went up to the Metropolitan Board to ask for a broad street from Tottenham Court Road to Charing Cross, at an estimated cost of £600,000. The enormous claims for compensation smothered an Act for a railway between Euston Square and Charing Cross. Cannot this scheme be revived, with a subsidy from the Metropolitan Board? or could not an arrangement be made under which the Metropolitan Board (which buys cheaper than a company) should clear the ground, and receive so much from a railway company? The Home Secretary (Mr. Bruce) performed the task of proposing the health of the veteran and venerable president with considerable skill, after the avalanche of oratory that had preceded his effort. Mr. Bruce said:

> At a time when many grey-haired men now present were still unborn, our president was serving his country in the army of his sovereign. He took part in the hot attack and honourable repulse at Bergen-op-Zoom; he shared the triumphs under the Duke of Wellington at Vittoria; and in threading the passes of the Pyrenees with the British army he first gained that experience which led him there again for more peaceful purposes. He watched by the cradle of engineering as applied to railways, and has himself been engaged in some of the most important works of this country; but it is in foreign countries that you must look for the chief consummation of his fame, and there is hardly a country, from Russia to the Northern and Southern States of America, in which he has not left some signal monument of his energy and ability. There may be some persons who may lament that the talents of your president were not exclusively restricted to his native country, but I confess I am not one of those—nor do I think you share in that feeling—who feel that we ought to confine our native talent in these matters within the limits of our own land, but that the cause of social and commercial progress is advanced by British talent and energy being diffused amongst other countries of the earth; and I believe when your president spanned the Dneiper, or carried his gigantic undertaking through the rocky passes of the Pyrenees, or when he encountered the difficulties presented by nature amongst the forests of Brazil, he was serving the cause of his native land as well as when he was engaged in mapping out the railway between Manchester and Liverpool, or constructing the other great works in this country with which he has been connected.

And so, with a very modest reply from the president, this dinner ended in a wonderfully cheerful manner, considering the universal dulness of the pursuits in which the professional guests are interested.

A discussion in the House of Commons last Tuesday, on the defects of the transit between England and France, showed once more very plainly that if they manage the ornamentation of Paris much better than of London, in provincial France the public works are much worse managed than in England. One of the special grievances put forward by Sir William Gallwey, who introduced the subject, was that the South-Eastern Railway had constructed, at their own cost, a port at Folkestone, and used it at stated times in preference to Dover. In France nothing of the kind has happened, because local and vested interests are too strong. On the French system, Liverpool would have been permitted to obstruct the Holyhead Railway and Ferry; Dover would have made Folkestone Harbour impossible. The contrasts between the existing facilities for embarking and disembarking at Dover, and Folkestone, and Calais, and Boulogne speak for themselves. Two schemes have been submitted to the French Government—one for improving Boulogne by extending the piers, and laying down rails to their extremity, at a cost of half a million sterling; the other, for constructing an entirely new port, for which an English contractor is ready to find the funds, and which this week received the assent of a committee of the House of Commons. Lord Lyons reports that the French Government agrees in the advantage of facilitating and accelerating communication between the two countries. "The difficulty of taking any "practical measures on the subject appears to be increased by the "rival claims of Calais and Boulogne, and by the strenuous oppo- "sition of both to all plans for forming a new harbour. The "process of consultation before decision is even more compli- "cated than our parliamentary contests. The scheme of Messrs. "Waring for constructing a port at Andreselles was made the "subject of a conference between different departments of the "French Government, which resulted in a discussion in favour of "its being taken into consideration. This preliminary for- "mality having been accomplished, the scheme was referred to a "commission of inspectors. Here, however, the Minister of "Marine intervened, and required that before going any further "the Department of Public Works should consult a naval com- "mission. The naval commission reported favourably, and the "affair was sent back on the 22nd inst. to the commission of in- "spectors." In the present state of French politics, the Government can scarcely afford to offend both Calais and Boulogne. In the meantime, Mr. Page has a scheme for making Boulogne a harbour of refuge for vessels of the largest tonnage—ingenious, and perhaps practicable; but then he has not, like Mr. Fowler, a contractor as his ally, ready to execute the work, without taxing the much-tried exchequer of France.

A request for better means of communication between Westminster and St. James's enabled Mr. Ayrton, while peremptorily refusing a carriage road across St. James's Park and Ornamental Water, to make a temporary, but important, concession. As long as King Street is blocked up during the construction of Government offices in Downing Street, carriages and horsemen are to be permitted to pass from St. James's Palace past the Horse Guards, out at Storey's Gate. Considering that Her Majesty has conceded a right of way for cabs past Buckingham Palace, it is difficult to see why the precincts of the Horse Guards should be sacred. We trust this temporary road may become permanent, but to make it truly convenient the steps by the Duke of York's Column should be replaced by a carriage road on either side, gradually sloping from the quoit-throwing female in Waterloo Place. This would give a direct road for private carriages between Regent Street and the Houses of Parliament. Nothing but a makeshift would justify the road down and up St. James's Street, with its two sharp turns past the Guard House into the park. It would be very nice to have a carriage road past the Metropolitan Board of Works from Charing Cross into the Mall, but Mr. Ayrton tells us that the Government have no money for any such improvements, and the Metropolitan Board have other more important fish to fry than such a short, costly, and picturesque improvement. Why horsemen should, and unprivileged carriages should not be allowed to pass in and out of Constitution Hill gate to the park is a mystery. It is said that George III. offered an Irish peerage in preference to park privileges, but that was before tea-dealers carts drove through Buckingham Gate and St. James's Palace Yard. The alterations in Hyde Park and Kensington Gardens, for the purpose of giving space to the Albert Monument, are decided improvements. Horsemen could well exchange the bit of Rotten Row they seldom used, for a nearly complete circle of the park. An opening with gates through the dead wall from Kensington to the broad walk of Kensington Gardens would be another considerable improvement of little cost. Mr. Robinson, the author of "Parks "and Gardens of Paris," has criticized the planting and management of the trees of our parks with just severity in a series of illustrated articles in the *Field*, and suggested that Portland Place should be so far carried through the Park Crescent Gardens as to make Regent's Park visible from Langham Place—a work of little cost and great results, but not, we fear, to be undertaken without the permission of the hermit Duke of Portland. A Rotten Row along the broad walk of Regent's Park would add greatly to the gaiety and amusement of the foot-passengers. Who knows what a spirit of rivalry, and a determination to show that he is not so black as painted by Mr. Cowper Temple and Lord John Manners, may lead Mr. Ayrton to do in the way of park ornamentation and amenities?

The debate and division in the House of Commons on Thursday last, on Mr. Buxton's Metropolis Bill, compels us to return to the perilous condition of the Corporation of London. The committee appointed by the Corporation to consider the whole subject has so completely evaded any recommendation of reform, that it would much more wisely have taken the bull by the horns, and advice of that stiff Tory, Alderman Sidney, and declined to make any report at all. The temper of the House of Commons is distinctly shown in the debate on Mr. Buxton's sweeping measure; it is more significant and instructive, except to the wilfully blind and deaf, than the division. By a majority of 130 to 61, the House referred the Bills to a select committee, which will have power to inquire into the whole question of the metropoiltan municipalities. But amongst the minority were not only the thick-and-thin supporters of the Corporation, like the Recorder and Alderman Lawrence, but staunch Conservatives like Mr. Bentinck—who, in his speech, advocated reforms of a different *form*, although not less sweeping than those sketched by Mr. Buxton's Bills—and unattached Whigs of the old school, like Sir George Grey, who will be found, when the time comes, voting for the extinction of the most cherished privileges and monopolies of the City of London. The friends of the Corporation cannot learn too soon that it is threatened with reform and reconstruction, not because it is rotten and corrupt, but because it is an unwieldy machine, as much out of date as the magnificent state barge which conveyed the Lord Mayor up the Thames when he was Chief Conservator of London's river. Two hundred and twenty-six Aldermen and Common Councilmen once represented, through the Livery and City Companies, every important trade and manufacture of the kingdom—from weavers to goldsmiths, from fishmongers to wax chandlers. Now the Companies represent nothing but banquets and hole-in-the-corner charities, and the Common Council does not even represent the City Companies. If there is anything in Mr. Chamberlain Scott's statistical argument that the City rules not only its resident inhabitants, but the millions who come into the City in the morning, and depart in the evening, then, as these people are taxed in coal and wine for the City, they have a right to representation which they do not enjoy under the present ancient municipal form. But reform is demanded not to carry out abstract theories, but for practical reasons. The Corporation now spends between £30,000 and £40,000 a year on a judicial staff kept up for the benefit of the whole metropolis, and insists on maintaining this costly esta-

blishment for the sake of the patronage and influence it affords. The imminent reform of our criminal procedure, if nothing else, would sweep this anomaly away. Prisons and police are also sources of unnecessary charge on the square mile of City property. Other useless charges, retained for the sake of patronage and imaginary dignity, might be named. A more serious defect exists in the constant state of conflict between rival powers within the City boundaries, as well as with all coterminous authorities around. The City owns three bridges, rebuilt, in a great degree, out of the coal and wine taxes. These bridges are under the control of the City Architect, who is not an engineer; while the pavement, sewers, and outsides of the houses leading to these bridges are, as well as all other streets, under the management of the engineer of the Commission of Sewers, who is not an officer of the Corporation at all, and who is even at times in hostile collision with the City Architect about the value of property in which the Corporation and Common Council are both interested. Again, the *lâches* of the Corporation, its steady opposition to all work not connected with digestion, forced the Government into creating the Metropolitan Board of Works (as recommended by the commissioners of 1854). The Metropolitan Board has its engineer and architect. The result is that triangular duels are continually taking place between the legal and constructive officials of the Common Council, the Commissioners of Sewers, and the Metropolitan Board, for which the metropolitan ratepayers have to pay in money and delay. This sort of chaos cannot be permitted to continue. One rod of power must swallow up the other two. The Corporation of London, according to Sir Robert Peel's formula, has three courses open to it. It may elect to be at the head of the municipal powers of the whole metropolis, under a new constitution; or it may decide to stand aloof, and present a plan, under which, with its numbers reduced to a hundred, with aldermen elected for seven years, without the incumbrance of police, judges, Irish Absentee Society, &c., if it prefers to rule the square mile of the City; or, sitting apart, it may do nothing but await the worst, relying on its great parliamentary influence (about which the last division raises some doubts), and supinely see itself stripped of every privilege that a timely compromise might have retained. The favourite cry of the Common Councilman is "*privilege*," which he repeats as pertinaciously as Tennyson's farmer did "*proputty*," but outsiders want to know what the word means. Does it mean dinners at the Mansion House and Guildhall, or the right of appointing a Recorder and Common Serjeant, with a staff of law officers sufficient to ruin any ordinary principality? or does it mean police and prisons, with their endless patronage, or porterage, and metage, and watermen's monopolies? A reformed Corporation, representing the whole of the metropolis, might still have three or four magnificent banquets every year still to entertain foreign potentates and ambassadors, Her Majesty's Ministers and Opposition, the celebrities of the Bench and the Bar; but doubtless the Lord Mayor would cease to be mulcted for entertaining on venison and turtle a series of guests, male and female, of the Common Council tribe, whose gala fare at home is roast beef and Yorkshire pudding, and whose only qualification is relationship or acquaintance with some one who could vote for Lord Mayor in the highly improbable event of a contest. After the division of Thursday, no politician of the slightest experience can doubt that the Corporation of London, partly disestablished and partly disendowed, will be entirely reconstructed in accordance with modern wants and ideas, in spite of the hysterical protests of the advanced Radicals who form the majority of the Common Council.

The Tramways Bill, as it has come out of the select committee, is a most important alteration in our system of legislation, as applied to public works. A project for a tramway may be sanctioned by a provisional order of the local authority of any district; or, if the local authority refuses its sanction, by the Board of Trade. The Board of Trade may, if it thinks necessary, direct an inquiry in the district as to the propriety of any application. After a provisional order is ready, and before it is delivered by the Board of Trade, the promoters, unless they are the local authority, are to deposit 4 per cent. of the estimated cost of the tramway into a prescribed bank. These provisional orders will be the subject of a public Bill, to be introduced by the Board of Trade; but, after introduction, any one having a *locus standi* may oppose any of the provisional orders included in the general Bill, and have it referred to a select committee. The Bill gives wide powers to local authorities to make tramways, and levy or lease tolls on them. Facilities are given to local authorities to borrow money for the purpose of making tramways for any time not exceeding thirty years. The Bill also gives large powers for breaking up streets, settles the proportion of road to be kept in repair by owners of tramway, and gives power to alter the position of gas and water pipes and telegraphic apparatus. In fact, this Bill will enable a tramway to be carried out by a short clause of a general Act, where there is no substantial ground of opposition.

Circular to Gas Companies.

The Gas and Water Facilities Bill has passed through committee with but slight and unimportant alterations. An amendment to clause 3, moved by Mr. Cawley, and carried, adds the words, "or to maintain and continue," after the word "construct." This addition was perhaps necessary to make the Bill clearly applicable to the cases of existing non-statutory companies. In the same clause Mr. Shaw Lefevre obtained the insertion of the words, "corporation or person," after the word "company," with the obvious view of protecting existing interests. The amendment to clause 4, moved by Mr. Lefevre, which proposed to dispense with the consent of a Local Board, if the objections were merely factious or ill-founded, encountered the opposition of Mr. Candlish, who appears to think a Local Board an infallible authority. Mr. Cawley, however, justly pointed out that at present the consent of a local authority is not necessary to an application to Parliament for powers, and therefore the proposed amendment only left the parties in the same position they are in at present. In the end this amendment was also carried. Mr. Cawley's amendment to clause 13, which would have made the Act applicable to the metropolitan companies for the purpose of amalgamation, encountered a more serious and, indeed, fatal opposition. Mr. Locke repeated the old charges against the metropolitan companies, that their simple object was to keep up the price of gas and their dividends, to the utter neglect of public interests; and therefore he argued that it was necessary that all their proceedings should be severely scrutinized. Mr. Goldney shared the same opinion, and seemed to think that no scheme for the amalgamation should be approved by the Board of Trade unless it provided for a reduction of the price of gas. Mr. Shaw Lefevre, who would really seem to be badly informed on the operations of his own department, said the metropolis was excepted, because the metropolitan gas question had always been the subject of special legislation; and he might have added, because the amalgamation of the metropolitan companies, under the superintendence of the Board of Trade, has been sufficiently provided for by special legislation. He pointed out that the Bill was intended to meet the cases of the numerous small companies scattered over the kingdom. Mr. Cawley's amendment was put and negatived, and the remaining clauses were agreed to in the committee. The Bill, however, is not yet safely through the Commons. On the consideration of the amendments, Sir C. Adderley contended that the Home Office, which is at present the central department in all matters connected with local government, and not the Board of Trade, is the proper authority to grant provisional orders. There is not much in this objection. The Home Office is certainly the central department in matters connected with local government properly so called. But this Bill is intended to provide for the cases of commercial companies whose undertakings should be entirely independent of local authorities, as much so as railways, which have always been under the superintendence of the Board of Trade, and they would seem to be more fitly placed under this department than under one which is purely concerned in governing. The great objection, as we have already said, is that the Board of Trade is overworked. So, indeed, is the Home Office. But both departments are elastic, and Parliament must choose between them. Sir C. Adderley threatens to renew his opposition on the third reading, but there is no doubt the Bill will pass the House of Commons as it now stands. In the Lords, however, things may not go so smoothly. There the Bill will have to encounter the lynx eyes of Lord Redesdale, and will be critically scanned by the law lords, who may possibly take Sir C. Adderley's view of the matter.

The Metropolitan Board of Works showed the importance they attached to the office of gas examiner by offering absurdly small salaries to the officers, and they have consistently followed it up by appointing to the posts young men scarcely out of their teens, and in some cases with but little experience in the duties they will be required to perform. One member, with less consistency, opposed the appointment of a gentleman, aged 22, on the score of his youth; and in another case advocated the appointment of a gentleman of 19, for reasons doubtless well known to himself, but not so apparent to anybody else. The same member showed his profound ignorance of the Acts under which the appointments are made, by stating that the "chief gas examiner" (we are not certain as to whom he alluded) "determined the mode of examination, "and the instruments to be used;" the fact being that the examiners, chief or not, have no more to do in determining the mode of examination, and the instruments to be used, than the Metropolitan Board themselves.

The Local Board of Luton took the sensible advice given by one of their number, and went home and slept upon Mr. Copcutt's

proposal. Their subsequent reflections induced them to take the wisest course they could adopt—viz., to endeavour to establish good business relations with the gas company, who met them in the most conciliatory and liberal spirit. Thus the quarrel which Mr. Copcutt tried to foment is likely to be avoided, and for the future the public lamps of Luton will be lighted by the Board, and the gas will be charged for on an average meter indication—one meter to twenty lamps—by which arrangement the town will gain rather than the company. We have to correct a misstatement made in our last respecting Mr. Copcutt. He informs us that he is not connected with the shoe-making firm of Francis and Henry Copcutt, and that he never walked about with a Fitzmaurice light on his head, but that he has devoted thirty years of his life to the study and practical demonstration of chemistry, gas, and natural science, and has invented many improvements in gas lighting.

A strange case of assault, but one which, we are sorry to read, is of frequent occurrence among the stokers of the Chartered Company, was recently tried at the Middlesex Sessions. A man at one end of a retort threw in a pailful of water, which resulted in the severe scalding of a man at the opposite end. Brutality of this sort may possibly be checked, even by the slight punishment awarded in this case, probably on good grounds. But the case painfully illustrates the necessity for a cordial understanding between the men employed in charging and discharging double-mouthed retorts. It is satisfactory to know that gas managers are in many instances doing their best to promote the moral welfare of the men in their employ.

The annual meeting of the British Association of Gas Managers is fixed for the 7th, 8th, and 9th of June, which last-named day will be devoted to a visit to the Beckton works. The programme promises to well sustain the interest of these meetings. A joint lecture will be given by Messrs. Kirkham and Sugg, "On Photometry as applied to the Estimation of the Value of Coal Gases." Mr. F. W. Hartley also promises some "Remarks on Photometry," and a paper by Mr. C. Heisch is announced, "On the Method of Testing the Illuminating Power of Gas, with special reference to Burners." Practical papers "On Setting and Working Retorts," and "On Charging and Discharging Retorts by Machinery," are promised by Mr. Cathels and Mr. Somerville. Mr. Morton will introduce the subject of "Sunday Labour in Gas-Works," and Mr. Goddard will treat of "The Application of Gas to the Generation of Steam." Papers are also promised "On Scrubbers," "The Manufacture of Tar Pavement," "On Stoppage in Ascension-Pipes," "On Gas-Meters," "On Artificial Alizarine," and "On a New Form of Gas-Exhauster."

A lamentable accident, which illustrates at once the reckless carelessness and bravery of some men, has occurred at the Beckton works. A well is being sunk there, and it might have been supposed that every man engaged in well-sinking would be aware of the danger there is of carbonic acid accumulating in the hole. Nevertheless this knowledge—if he possessed it—did not deter a man from going down the well without first taking the common precaution of ascertaining whether the air was foul or not. Unfortunately it was foul, and he was soon overcome, and fell. Another went to his rescue, and immediately shared his fate. Then others went down, until at last there were seven senseless at the bottom; and only two were got up alive. We notice this accident more particularly to call attention to a very simple expedient adopted by Mr. Gossage, of Widnes, for displacing carbonic acid and admitting pure air to a well. He makes a bundle of straw of very nearly the same diameter as the hole, and by means of a rope lowers and raises the bundle several times, in that way, of course, expelling the foul air and replacing it with pure. This simple expedient cannot be made too widely known.

A correspondent informs us that the use of coke as fuel at the Dover Corporation Water-Works has resulted in an economy of £315 per annum, the cost of coal being £1050 as against £735, the cost of coke. To make the comparison complete, the cost per ton of the coal and the coke should have been stated.

We publish in this number a valuable paper by Professors Silliman and Wurtz, "On Flame Temperatures, in their Relations to Composition and Luminosity," in which they make some important corrections in Bunsen's method of calculating the temperatures of the combustion of gases. One merit of the paper, which will be appreciated by many, is the substitution of arithmetical processes for the complex formulæ which perplex the non-mathematical reader of Bunsen. The practical conclusions arrived at by the authors have much interest, and their further investigations on the subject will be looked for with impatience.

Professor Rood's paper, "On a Photometer for Determining the Amount of Light Reflected from Metallic Surfaces at Different Incidences," will also be read with interest.

Parliamentary Intelligence.

HOUSE OF LORDS.

Monday, May 9, 1870.

The Eccleshill and Bolton Gas, and the Leeds Corporation Gas (Purchase, &c.) Bills, were read a second time, and committed.

Tuesday, May 10.

The Paisley Gas Bill was read a third time, with the amendments, passed, and sent to the Commons.

The Buxton Gas Bill was brought from the Commons, and read a first time.

The Beccles Water; the Fylde Water; the Shoreham and District Water; the Southport Water; the Yeadon Water; and the Hyde Local Board Bills, were returned from the Commons agreed to.

The Chiltern Hills Spring Water, and the Brecon Gas Bills, were returned from the Commons agreed to, with amendments. The said amendments were considered and agreed to.

Thursday, May 12.

The following Bills received the Royal Assent:—The Chester Gas; Mansfield Water; Runcorn, Weston, and Halton Water; Newport (Isle of Wight) Gas; Airedale Gas; King's Lynn Gas; Wrexham Gas; Hyde Local Board; Beccles Water; Fylde Water; Shoreham and District Water; Southport Water; Yeadon Water; Chiltern Hills Spring Water, and the Brecon Gas.

The Eccleshill and Bolton Gas Bill was reported, without amendment.

The Hebden Bridge Gas Bill was read a second time, and committed.

The Yeovil Improvement Bill was brought from the Commons, and read a first time.

The Great Central Gas Consumers Company; the Shipley Gas; and the Ruabon Water Bills, were referred to a Select Committee, consisting of Lord Mont Eagle (chairman), Earl Fortescue, Lord Sheffield, Lord Foxford, and Lord Wynford, who will meet on Monday, May 16, at eleven o'clock.

Friday, May 13.

The Leeds Corporation Gas, &c., Bill, and the Kirkcaldy and Dysart Water Bills, were brought from the Commons, read a first time, and referred to the Examiners.

Monday, May 16.

The Lord Chancellor informed the House that the further Standing Orders applicable to the Buxton Gas Bill had not been complied with.

The Leeds Corporation Gas (Purchase, &c.) Bill was reported, with amendments.

The Reading Gas Bill was read a second time, and committed.

The Eccleshill and Bolton Gas Bill was read a third time, and passed.

The House was informed that the opposition to the Ruabon Water and Great Central Gas Bills was withdrawn.

The Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill was brought from the Commons, and read a first time.

Tuesday, May 17.

The Reading Gas Bill was reported, with an amendment.

The Ruabon Water Bill was reported, with amendments.

The Aberdare Local Board Bill was read a second time, and committed.

The Dartmouth Water Bill was read a third time, and passed.

The Paisley Gas Bill was returned from the Commons, with the amendments agreed to.

The St. Albans Gas Bill was returned from the Commons agreed to, with amendments.

Thursday, May 19.

The St. Albans Gas Bill.—The Commons amendments were considered and agreed to.

The Hebden Bridge Gas Bill was reported, without amendment.

The Blackburn Corporation Improvement Bill was read a second time, and committed.

The Shipley Gas Bill was reported from the Select Committee, with amendments.

Friday, May 20.

The Buxton Gas Bill.—The Standing Order not complied to, to be dispensed with.

The Yeovil Improvement Bill was read a second time, and committed.

The Reading Gas; the Leeds Corporation Gas (Purchase, &c.); the Bath Corporation; and the Ruabon Water Bills, were read a third time, with the amendments, passed, and sent to the Commons.

The Oldham Corporation Water, &c., Bill was brought from the Commons, and read a first time.

A petition was deposited against the Ashton-under-Lyne, Stalybridge and Dukinfield (District) Water Bill, from J. T. Hibbert and another.

HOUSE OF COMMONS.

Monday, May 9, 1870.

The Hyde Local Board Bill.—The Lords amendment was agreed to.

The Brecon Gas Bill was read the third time, and passed, with amendments.

The Buxton Gas Bill was read the third time, and passed.

The Chiltern Hills Spring Water Bill was read a third time, and passed, with an amendment.

The Kirkcaldy and Dysart Water Bill, and the Leeds Corporation Gas, &c., Bill, as amended, were considered.

The Oldham Corporation Water, &c., Bill was reported.

Tuesday, May 10.

The Beccles Water; the Fylde Water; the Shoreham and District Water; the Southport Water; the Yeadon Water; and the Yeovil Improvement Bills, were read a third time, and passed.

The Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill, as amended, was considered.

Wednesday, May 11.

The St. Albans Gas Bill, as amended, was considered.

The Littlehampton Water Bill was read a second time, and committed.

Thursday, May 12.

The Kirkcaldy and Dysart Water Bill, and the Leeds Corporation Gas, &c., Bill, were read the third time, and passed.

Friday, May 13.

The Leeds Gas Bill, and the Dublin Corporation Water Bill, were reported.

The Imperial Continental Gas Association Bill was reported, without amendment.

The Carmarthen Gas Bill was reported, with amendments.

The Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water Bill was read a third time, and passed.

Saturday, May 14.

A petition was deposited against the St. Helen's Gas Bill, from the inhabitants of St. Helen's (in public meeting assembled).

Monday, May 16.

The Paisley Gas Bill.—The Lords amendments were agreed to.

The St. Alban's Gas Bill was read a third time, and passed, with an amendment.

The Oldham Corporation Water Bill, as amended, was considered.

The Birmingham Water Bill was read a second time.

GAS AND WATER FACILITIES BILL.

The House having gone into committee on this bill,

Mr. Cawley moved to insert in clause 3 the words, "or to maintain and continue," which he said were necessary in order to meet the cases of a large number of gas companies—nearly 700—who have not got statutory powers.

The amendment was agreed to, and the words, "corporation or person," were also inserted after "company," with a like object, the latter amendment being moved by Mr. Lefevre.

Mr. Cawley them moved to insert in another part of the clause the words, "or to amalgamate their undertakings," the object of the amendment being, he said, to enable gas companies to amalgamate their undertakings under a provisional order, without coming to Parliament in the usual way.

Mr. Locke said he did not know whether he could agree to this amendment, for it had not been found that gas had been supplied to the public cheaper in consequence of these amalgamations. The whole of the benefit had gone to the gas companies themselves, and therefore he should like to know what check the Board of Trade proposed to place upon these companies if they were allowed to amalgamate. Besides he found that his honourable friend was not content with dealing with gas companies throughout the country, but had given notice of an amendment altering the whole scope of the bill. The last clause expressly provided that the bill should not apply to the metropolis, but the honourable member had given notice of an amendment to make it apply to the metropolis. Now the honourable gentleman might deal as he pleased with the rest of the community, but so far as the metropolis was concerned he should decidedly object to this amendment until he knew what check the Board of Trade would put on the companies who proposed to amalgamate.

Mr. Shaw Lefevre said he should have no objection to the addition of those words if the measure were not extended to the metropolis. He agreed with Mr. Locke that it was not desirable to extend the powers of amalgamating by a provisional order to the gas companies of the metropolis. The provisional orders must go before the Board of Trade, who would insert what conditions they thought fit in the interest of the public.

The amendment was then agreed to.

In clause 4, which requires the consent of the local authority or road authority to the provisional order,

Mr. Shaw Lefevre moved to add the words, "unless the Board of Trade, in any case in which the consent of the local authority or road authority is refused, are of opinion, after inquiry, that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in such case they shall make a special report stating the grounds upon which they have dispensed with such consent."

Mr. Candlish objected to this amendment. The clause, as it stood, made the consent of the local authorities essential to the passing of the provisional order, and the words which his honourable friend proposed gave the Board of Trade the power of setting aside their judgment. He thought that was much too strong a measure, and it was one which was altogether unknown to our legislation. He could understand that there might be some road authorities which might stand in the way of a gas company, and if his honourable friend would strike out the words relating to the local authority he would agree to the remainder of the amendment. He moved to amend the amendment by striking out the words, "local authority or."

Mr. Cawley thought, when his honourable friend reflected and looked at the whole machinery of the bill, he would see that the amendment as it stood was only placing the parties in the same position that they would be in if they came for a private Act of Parliament. At present any gas or water company had a right to come to Parliament without the consent of the local authorities. The local authorities, of course, were at liberty to oppose the bill, and under this Act they would be at liberty to oppose the provisional order, because the provisional order must be sanctioned by Parliament. If the amendment were altered as proposed, it would enable the local authorities to object to the provisional order for their own purposes. He thought the amendment of the Vice-President of the Board of Trade should be allowed to pass in its integrity.

Mr. Shaw Lefevre said his reason for moving the amendment was this, that he found a great many more water and gas companies had laid their pipes in the roads without statutable authority than he had any idea of. There were no less than a thousand of such companies. They had not come to Parliament, but had laid down their pipes with the consent of the local authorities. The local authorities might refuse their consent to the provisional order in order to force the company to give them better terms, and it was thought reasonable that the provisional order should proceed notwithstanding. His honourable friend (Mr. Candlish) said the clause was unknown to legislation. He thought his honourable friend was under a mistake, because it was exactly the same clause as had already passed in the Tramways Bill. In some cases the consent of the local authorities might be unreasonably withheld, and in those cases he proposed that power should be given to the Board of Trade to dispense with such consent.

Mr. Whitwell thought it most undesirable, where streets were already used for gas-pipes, that a new company, notwithstanding that the local authority was opposed it it, should be empowered to break up the streets. He thought it a great power to give to the Board of Trade to compel the local authorities to receive any number of gas-pipes into their streets.

Mr. Shaw Lefevre said he thought his honourable friend did not quite understand the object of the amendment. These gas companies, having laid down their pipes without any legislative authority, were liable to an indictment. The local authorities could at any time withdraw their consent, and indict the companies for laying down the pipes. And cases of that kind had occurred where the local authorities, having given their consent, had withdrawn it, and then indicted the company for laying down the pipes without consent. And precisely the same thing might occur under this bill. The local authority having given its consent to the provisional order, might withdraw it. That would be quite unreasonable, and it was to avoid that that he had introduced this amendment.

Mr. Candlish then withdrew his amendment, and Mr. Lefevre's amendment was agreed to.

Mr. Cawley moved in clause 13 the insertion of the words, "except for the purpose of the amalgamation of gas companies." He was sorry that the honourable member in charge of the bill objected to this amendment. For his own part, he did not see why there should be any distinction between the metropolitan gas companies and other gas companies throughout the kingdom as regarded this particular question. He was the more surprised at the honourable member for Southwark objecting to the amendment, because he was very desirous of a similar provision being introduced into the Tramways Bill. His honourable friend should bear in mind that if the object was desirable in other localities it was also desirable in the metropolis. Power being given to the Board of Trade to lay down the terms on which the amalgamation should take place, the same being afterwards confirmed by Parliament, he thought every precaution was taken for the protection of the interests of the public. And he could not conceive why the metropolitan companies should be forced to come to Parliament when other companies could effect the object by a provisional order. The parties would have the opportunity of proposing terms first to the Board of Trade, and then of coming to this House on the confirmation of the order. Therefore he hoped they would not have a distinction between the metropolis and the other parts of the country. Certainly this amendment could do no harm, and it would save them from exceptional legislation as regarded the metropolis.

Mr. Locke said he was sure his honourable friend had in mind what took place last year in the committee on which they were both placed under peculiar circumstances, neither of them having a vote, but having the right to state their views with regard to the Imperial Gas Company. He well remembered the fight which his honourable friend made on that occasion in favour of the gas company, and how he supported the bill to enable the gas company to extend their undertaking, and at the same time how he tried to curtail, as far as he possibly could, all the benefit which the public were entitled to. Now, he should object to this amendment which his honourable friend proposed to introduce into this bill, unless it were accompanied with words which should point out and clearly direct that the amalgamation should take place under the provisions which it had been considered were necessary to be imposed in regulating gas companies in London when they asked for any further powers—the provisions which were agreed upon by the committee which was presided over by the right honourable gentleman now at the head of the War Department. If that were done there might be no objection to it; but they all knew very well what was the object of the gas companies when they amalgamated. It was to relieve themselves from expense, to keep up the price of gas, to increase it, or at all events to keep it up at the price they were then charging. In fact, legislation on these matters took place entirely for their interest, and the public were sacrificed. He recollected the course taken by his honourable friend, who, with that pertinacity that belonged to him, got, in a great measure, his own way. Therefore he said, "*Timeo Danaos.*" He did not wish any of these efforts to succeed, and he hoped that his honourable friend who represented the Board of Trade would not agree to this amendment.

Mr. Goldney said he had been mixed up for a long time with gas matters in the metropolis. There had been a long contention, and a successful contention, with regard to the supply of gas, and the companies who supplied the metropolis had had to agree to certain terms. There was an arrangement in 1868 by three of the companies to amalgamate. They saved a large expense, and it was hoped that a portion of that saving would go to the public, but it did not. Unless the Board of Trade had power to regulate the price, he thought they should not allow these amalgamations. It was contended for a long time that it was impossible to manufacture gas for the metropolis otherwise than in the metropolis. But three companies had taken their works from the metropolis; they had saved the metropolis from great inconvenience by removing the works from the metropolis; they had carried this out as a great experiment, and at a great expense. These three companies had undertaken to supply the public in their districts with gas at a much lower rate than the other seven companies did, and what was wanted was, that if they came to Parliament for further powers, Parliament should have the power to impose restrictions on them as regarded price, and such further restrictions as, on scientific investigation, it was deemed right should be carried out. The sum paid to the metropolitan gas companies for gas supplied exceeded three millions sterling per annum, and if this bill enabled them to maintain the price it would be a very great detriment to the metropolis. If the Board of Trade could say the price of the gas must be decreased, or the illuminating power increased, there could be no objection to this amendment. If not, the bill had better be left as it stood.

Mr. Shaw Lefevre said he excepted the metropolis, because the metropolis gas question was a very special one indeed, and had always been the subject of special legislation. The bill was intended for a totally different kind of gas companies—quite small companies. It was not intended to bring the large, the giant companies under the scope of this bill. He thought that the metropolitan gas companies, when they wanted further powers, should come to Parliament, and the bill should go before a committee of the House, rather than that they should go to the Board of Trade for a provisional order. He also gathered that when this matter was before the Metropolitan Board they vigorously opposed the proposition that the metropolitan gas companies should come under provisional orders, and contended that they should come directly to Parliament for any further powers that they might want. Under these circumstances, he trusted his honourable friend would not press his amendment. The honourable member assisted him when he proposed a similar provision as regarded metropolitan tramways, but there was this difference, that the Metropolitan Board of Works were in favour of the extension of tramways, but they were opposed to this bill.

Mr. Cawley said he thought, notwithstanding what the honourable member had said, that the arguments were in favour of this clause. The Board of Trade would have full power to deal with the matter. There was another point which his honourable friend overlooked, and that was that it would be much more satisfactory if these matters came officially before the Board of Trade. With regard to the observations of the honourable member for Southwark, he could only say that if he, before the committee of last year, defended the gas companies, it was because he thought that the honourable member, on the other hand, was endeavouring to injure the gas companies. When the honourable member spoke of the companies saving expense by amalgamation, he must remember that the public saved too, because the companies were limited in their dividends, and if the profits were beyond the amount required for those limited dividends, the public must necessarily get the benefit.

Mr. Shaw Lefevre said he must remind his honourable friend that the gas companies did not show an intense anxiety to benefit the public when they were before Parliament in 1868.

The amendment was then put and negatived, and the remaining clauses of the bill and the schedule having been agreed to, the bill passed through committee.

Tuesday, May 17.

The Gaslight and Coke Company's Bill was reported.

Wednesday, May 18.

The Carmarthen Gas Bill, as amended, was considered.

Thursday, May 19.

The Enniskillen Borough Improvement Bill was reported.

The Oldham Corporation Water, &c., Bill was read a third time, and passed.

The Halifax Water, &c., Bill.—Order that the Bill be read the third time, read and discharged. Bill recommitted to the former committee.

GAS AND WATER FACILITIES BILL.

On the order of the day for the consideration of the amendments to this bill,

Sir C. Adderley said there was a commission now sitting for the consolidation of local Acts, and he thought there ought to have been some communication on the part of the Government with that commission before they proceeded with

this bill. At present the central department in all matters connected with local government was the Home Office, whereas this bill referred these companies to the Board of Trade as the central department, and it seemed to him that if legislation took place on the report of the commission, a fresh bill must be passed, referring these companies to the same central department to which they recommended all local authorities to be referred. He protested against the very Acts which the commission had to consolidate being further altered during the progress of their inquiry. He asked the Government to state why, in the first place, no communication was made to the commission on the subject, and why reference under this bill was to be made to a different department from that which the commission recommended should be the department to which other local authorities should refer.

Mr. SHAW LEFEVRE said he very much wished that the right honourable gentleman had made his objection rather earlier. In point of fact, he had made some inquiry on the subject, and could not find that there was any ground for saying that this bill increased the work of the commission. As far as he could discover, what the commission had to do with was the law relating to local authorities. But this bill had nothing to do with local authorities. It was simply a bill to enable companies who had laid down their pipes and works to obtain legislative sanction, and also to enable those local authorities who wished to give their sanction to gas and water companies to do so. At present they were not able to do so, and therefore if a water or gas company had laid down its pipes without authority, it was liable to indictment, either at the instance of the local authority, or of any other person.

Sir C. ADDERLEY said the sixth clause ought to be amended, so that the board of reference should be the same as that of the other local authorities. By the bill it was provided that the Board of Trade should consider the application, and any objection made thereto.

Mr. HIBBERT agreed with his right honourable friend (Sir C. Adderley) that the passing of this bill in its present shape would cause a complication. He thought that this was the first time that the Board of Trade had had anything to do with gas or water companies. It seemed to him that unless the bill was very pressing it should not be proceeded with until after the commission had presented its report.

Mr. DODSON said he did not think that the complication apprehended by the right honourable gentleman would arise. This was a bill, the object of which was to substitute a provisional order for a private bill. Supposing this bill were not to pass, the only effect of that would be that the parties would have to come to a committee of the House for a private bill, instead of getting a provisional order which would be embodied in a bill to be laid before the House. It was simply the substitution of a cheaper mode than the obtaining of a private bill. Whether they obtained a private bill or a provisional order the complication was no greater.

Mr. SCLATER-BOOTH said the honourable gentleman failed to see that provisional orders had been hitherto obtained under the sanction of the Home Office, whereas what his right honourable friend objected to was that this bill required the provisional order to be under the sanction of the Board of Trade.

Mr. SHAW LEFEVRE said if he were to accept the amendment of the right honourable gentleman, the complication would be considerably increased, because then a company would not know whether to go to the Home Office or to the Board of Trade. As his honourable friend (Mr. Dodson) had stated, the only effect of the bill would be to enable gas and water companies to get legislative sanction for their works by a provisional order instead of by a private bill. The moment the provisional order was passed, the Board of Trade would have nothing more to do with the gas and water companies than they had at present.

The bill was then ordered to be read a third time.

Sir C. ADDERLEY said he would raise the question again on the third reading.

FRIDAY, MAY 20.

The NEWCASTLE AND GATESHEAD WATER Bill was reported.

The RAINHILL GAS AND WATER Bill was reported, with amendments.

The DUBLIN CORPORATION WATER Bill, as amended, was considered.

Legal Intelligence.

COURT OF CHANCERY.

(Before Vice-Chancellor Sir W. JAMES.)

THE WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY *v.* WRIGHT AND OTHERS.

Mr. KAY, Q.C., Mr. EDDIS, Q.C., and Mr. SHEED appeared for the nominal plaintiffs; Mr. AMPHLET, Q.C., and Mr. M'NAGHTEN for the defendants.

The bill in this suit stated that an annual general meeting was held on the 23rd of February, 1870, for the purpose (among other things) of electing two directors in the room of Mr. Benjamin Wright and Mr. Charles Price, who retired by rotation from the direction, and who offered themselves and were proposed for re-election. Mr. John Langton and Mr. Henry Palfrey Stephenson were also proposed to fill the office. A show of hands being called for, it was declared in favour of Messrs. Langton and Stephenson. A poll was then demanded on the part of Messrs. Wright and Price. Messrs. Henry Kimber and Joseph Holland were appointed by the chairman, Mr. Symonds Howell, to be scrutineers of the votes. The poll having taken place, the scrutineers reported the number of votes be as follows:—Wright, 3021; Price, 2945; Langton, 2936; Stephenson, 2860. The chairman thereupon declared Messrs. Wright and Price to be duly elected, and the secretary entered the above result on the minutes.

At the first board meeting after the above meeting (Mr. Howell being absent) there were present Messrs. Wilkins, Clarke, Blake, and Wright, and Mr. Blyth, the solicitor. Mr. Stephenson and Mr. Langton were also present. Soon after the meeting commenced business, Messrs. Blake and Wright withdrew from the meeting; whereupon those present passed resolutions ordering the minutes of the general meeting to be altered, by making it appear that the scrutineers had reported the number of votes in favour of Messrs. Langton and Stephenson, instead of Messrs. Price and Wright. They also passed resolutions authorizing Mr. Blyth to take legal proceedings to restrain Mr. Wright from acting (Mr. Price having meanwhile died), and they affixed the seal of the company to a retainer for that purpose.

At the next board meeting, Messrs. Wilkins and Clarke refused to attend unless Messrs. Langton and Stephenson were allowed to sit in lieu of Messrs. Wright and Price; Mr. Wilkins refused to bring or send the key he had taken away; and Mr. Lass, the secretary, refused to give the chairman the office keys, so that the business of the company could not be carried on.

On the 8th of March, 1870, Mr. Blyth filed the bill in Chancery, *in the name of the company*, against Messrs. Wright, Howell, and Blake, to contest Mr. Wright's election, and moved for an injunction to restrain him from acting. The defendants at once gave notice of motion to take the bill off the file, on the ground that it was filed without any authority on the part of the company. Both motions were argued on the 17th of March, 1870, when the Vice-Chancellor stated that there was sufficient ground for the counter motion to justify him in not refusing it, until the opinion of a general meeting of shareholders was ascertained, and he therefore did not grant the injunction.

A meeting of the shareholders was accordingly held on the 11th of April, 1870, when resolutions were passed by the shareholders disavowing the bill in Chancery, and requesting that it be taken off the file, confirming Mr. Wright's election, and the election by the directors of Mr. Robert Jones, C.E., in the place of Mr. Price, deceased, and removing Messrs. Wilkins and Clarke from the office of directors, and appointing Messrs. Ransome and Newsome in their stead. The result of the meeting was brought before the court by the directors, who gave the necessary notice to bring on again their motion to take the bill off the file.

A motion was now made on the part of the defendants that the bill in the above suit might be taken off the file, having been filed without the authority of the nominal plaintiffs—the Wandsworth and Putney Gaslight and Coke Company; and that Mr. Edmund Kell Blyth, the solicitor by whom the bill was filed, might be ordered to pay to the defendants their costs of this suit and of the present application.

On the part of the nominal plaintiffs it was contended that, although Messrs. Langton and Stephenson were not nominally returned to act as directors at the general meeting held on the 23rd of February, they were *de jure* and *de facto* elected. For if the votes which were improperly received for Messrs. Wright and Price were deducted from the return, and those that were improperly rejected on behalf of Messrs. Langton and Stephenson were added to it, it would be found that Messrs. Langton and Stephenson were elected. This being so, they were *de jure* and *de facto* directors, and therefore the bill was properly filed, and the company are liable for the costs.

Mr. Byth was not personally represented.

The VICE-CHANCELLOR (without hearing a reply) said: I am of opinion that this motion must be granted as asked; the bill must be taken off the file, with costs to be paid by the solicitor. In one respect this bill is entirely new; I do not recollect ever hearing of a bill in which this court was called upon to try a question of *quo warranto* upon a scrutiny of votes. In truth, the bill was framed with full notice of that difficulty, because it alleges a direct case of fraud against the scrutineers and the chairman. It is impossible to deny that this is the substance of it—that the chairman appointed two partisans as scrutineers, and that the two scrutineers, by a conspiracy between themselves, wilfully falsified the return of the votes by inserting in the list bad votes on the one side, and by excluding good votes on the other. That is what it comes to, they well knowing that to be untrue. Then what appears is this: there was a meeting held, and at present, as far as I have heard the case, if I were sitting merely as scrutineer upon that election, I assume I should come to the conclusion that Messrs. Langton and Stephenson had a majority of legal votes—that is to say, I should come to the conclusion that the revocations were sufficient, and, beyond all question, proxies which had not been delivered within forty-eight hours were not admissible. However, what takes place? There was a meeting called, and I think I recollect sufficient of the affidavit brought before me on the former occasion to say this—that at that meeting, Mr. Kimber, who seems to have been a legal friend of the chairman, was appointed chairman's scrutineer, the chairman being at the head of one of the parties, and the other person appointed scrutineer was appointed after an appeal to the meeting to name a scrutineer; and his affidavit of what took place at that meeting satisfies me that he went to that meeting without any bias either one way or the other, and had nothing whatever to induce him to act otherwise than impartially. There were those two scrutineers appointed by the meeting. Now, it is said that the Act of Parliament does not provide for scrutineers. The Act of Parliament does not provide for the *minutiæ* of the election, it simply says that the election is to be at a general meeting. It is like everything else at general meetings of shareholders, the details of the proceedings must be regulated by the persons present, and by the chairman, and if his decision is quarrelled with it must be regulated by the majority of those present. Of course, it must be presumed that they do it all honestly and fairly. The meeting being held, without any dissentient voice, as far as I can make out, the meeting agreed that there should be two scrutineers appointed; that was reasonable and proper. Accordingly, those two gentlemen I have mentioned were appointed for the purpose of taking the votes. The votes were taken by them. There is no entry on the minutes of the proceedings to show that particular persons voted, or what were the number of good votes, or what were the number of bad votes. That has been made out before me upon evidence on the motion. Well, then, that can only be made out on a proper scrutiny. All that appeared upon that which is the legal record of what took place at the meeting was, that the show of hands was in favour of Messrs. Stephenson and Langton, that thereupon a poll was demanded, and that the chairman declared the poll open, and nominated as scrutineers Messrs. Kimber and Holland. A poll was thereupon taken, when the number of voters present, personally or by proxy, as ascertained by the scrutineers, was as follows—then the number is given. Then "the chairman declared Messrs. Wright and Price duly elected directors of the company. That is all that took place; there is no dispute whatever in point of fact—that is to say, of the fact that the scrutineers made this return. That being so, it appears to me that, *de facto*, at all events, I must presume that was done at the meeting, and that the meeting did declare—that the chairman, in the name of the meeting, did declare—Messrs. Wright and Price to be duly elected as directors; and that declaration, being entered on the minutes, appears to me to have exactly the same effect as the declaration of any other poll—that is to say, there is a return made; that return is good until it is brought into question before a proper tribunal in the proper manner; and thereupon *primâ facie* by that declaration Messrs. Wright and Price were elected at that meeting, subject, of course, to their election being brought into question afterwards. If that had really been done by way of fraud and conspiracy, which is alleged by the bill against the chairman and scrutineers, in all probability this court would have found its arm long enough, notwithstanding the decision of *Mozley v. Alston*, and other cases, to have dealt with such fraud as that; but in the absence of anything of the sort—and I am bound to say I am quite satisfied there was no fraud of any kind—in the absence of any mistake as to the admission of votes, or the mode in which the votes were taken, the matter would simply come to this: there is the return of the men who had the majority of votes. That return is good until it is set aside. How is it set aside? It is set aside by gentlemen who question the return. It appears to me the proceedings of the meeting of the directors on that point were the most extraordinary proceedings that I almost ever heard of. They were gentlemen who knew that they had not been returned as elected, who knew that the minutes of the meeting represented two other persons as being elected; they thereupon take their seats as directors, and having done so, they proceed to determine that, as directors, they were duly elected. I am rather surprised the other directors present allowed them to do that. It is quite clear they ought to have waited until there was a meeting, or to have called a general meeting. I cannot admit a thing of this kind—that in this company a man may say, "Although by a mistake on the part of the chairman or the scrutineers I was not elected as director, yet I will go and take my seat, and authorize a bill to be filed by the solicitor of the company, in the name of the company, for the purpose of asserting my right." That cannot be right. The truth is, there is always a mode of setting things in order in these companies. You can always call a general meeting if there is anything wrong; and, after all, it is the general body alone that this court has to regard. This court does not regard the office of director as a thing with respect to which a man has a vested right to say, "I was elected to the office, and I have a right to hold it." The office of director is nothing more than that of manager of a company. The company has full power to deal with its directors—to appoint them, to dismiss them, or to re-elect them; and if any dispute arises as to the propriety of the election of a director, the simple course is to call another general meeting, and to get the whole thing set right. I am of opinion that the way in which those two gentlemen (Messrs. Langton and Stephenson) have acted is certainly without any colour of right, in taking their seats at the board before there was any declaration or return of their election; and the solicitor is the person who

seems to have advised the proceedings, and accepted a retainer of those gentlemen who were not directors, and were not authorized in any way to pledge the credit of the company. In accepting that originally, he accepted it at the peril of its being avowed or disavowed by a general meeting of the shareholders. A general meeting of the shareholders has disavowed the proceedings, and desired that the bill should be taken off the file, as being not in accordance with the general views of the company. I therefore accede to that application, and order the bill to be taken off the file, and the costs to be paid by the solicitor.

Miscellaneous News.

METROPOLITAN BOARD OF WORKS.

At the Meeting of the Board on Friday, May 13—Sir JOHN THWAITES in the chair,

The CLERK read a report from the committee, to whom it had been referred to examine the several candidates for the appointment of gas examiners, under the Imperial and South Metropolitan Gas Acts, and to nominate not less than two for each district, with a view to the selection by the board of one for each appointment. The report stated that the committee had been unable in every case to carry out the latter part of their instructions, inasmuch as some of the candidates appeared, from the nature of their qualifications and previous employment, quite unsuited to discharge the duty of a gas examiner. All the candidates attended, and had been examined by the committee, and as the result they begged to submit the following names—viz., for

Chelsea	Mr. W. C. Young.
Camden Town	Mr. Robert Grimwood. Mr. Mostyn J. Salter.
Dalston	Mr. James Craik.
Peckham	Mr. James John Day. Mr. George M. Wood.

A letter had, since the preparation of the report, been received from Mr. Day, stating that he applied to be appointed to the Chelsea station, and was not prepared to accept the post of gas examiner at the station in Peckham, as its situation was too far from his place of employment during the day, and also from his residence.

On the motion of Mr. COLLINSON, it was resolved that Mr. Young be appointed for Chelsea.

Mr. ROGERS moved the appointment of Mr. Grimwood for Camden Town, which was agreed to.

On the motion to elect Mr. Craik for Dalston, Mr. NEWTON expressed a doubt as to the expediency of appointing a young man of 22 years of age to a post in which he would have to support the board should any proceedings have to be taken against the gas company.

The motion was, however, adopted.

On the motion to appoint Mr. Wood for Peckham,

Mr. ROGERS said this candidate was only in his nineteenth year, and was at present a student at King's College. He asked the board to consider whether a person under age could be properly appointed to carry out the provisions of the Act of Parliament. It was a very important question, as the board might have to apply, as had been done in the City of London, for very heavy penalties, and he doubted whether so young a man, however clever he might be, would be able to support a conviction.

Mr. NEWTON said the committee would not have returned the name of Mr. Wood unless he had been qualified; and if he was qualified, there could be no objection on the ground of his age. The board had to depend upon the chief gas examiner, who determined the mode of examination, and the instruments to be used.

Mr. ROGERS said the law required that the person signing the report upon which proceedings were taken should be the person appointed by the board.

Mr. FREEMAN thought the board would make a mistake in appointing a person under age. Their own examiner must sign the papers, and the chief examiner could not step in and set him aside. This young man would be officer of the board, and would have to give evidence. The better course would be to postpone the appointment, and refer the question again to the committee for consideration. In moving that, he did not wish to stand in the way of Mr. Wood, who might be a person well qualified for the office.

Mr. ROGERS seconded the amendment, which was put and carried, and the appointment postponed.

PAROCHIAL ASSESSMENTS.

By EDWARD RYDE, Esq.

[Paper read before the Institution of Surveyors.]

(*Continued from page* 383.)

MODE OF VALUING PROPERTY LIABLE TO BE RATED.—There are two estimates required by the Statute 6 & 7 Wm. IV., c. 96, which regulates parochial assessments—viz., "*gross estimated rental*" and "*rateable value.*"

The former is the rent at which the property might reasonably be expected to let from year to year, the tenant paying all usual tenant's rates and taxes and tithe commutation rent-charge (if any), the landlord bearing the cost of repairs and insurance and other expenses (if any) necessary to maintain the premises in a state to command such rent. The *rateable value* is so much of the *gross estimated rental* as remains after deducting therefrom the probable average annual cost of the repairs, insurance, and other expenses necessary to maintain them in a state to command such rent as aforesaid.

The actual words of the Statute are very simple when understood; but it is probable that no words in any Statute were ever more misunderstood, or ever caused more confusion and gave more trouble than they did. They are as follows:—

"No rate for the relief of the poor in England and Wales shall be allowed by any justices, or be of any force, which shall not be made upon an estimate of the net annual value of the several hereditaments rated thereunto—that is to say, of the rent at which the same might reasonably be expected to let from year to year, free of all tenant's rates and taxes and tithe commutation rent-charge (if any), and deducting therefrom the probable average annual cost of the repairs, insurance, and other expenses (if any) necessary to maintain them in a state to command such rent."

Soon after the passing of this Statute—viz., on the 3rd of March, 1837—the Poor Law Commissioners issued a circular defining gross rent as the rent which would be paid to a landlord who himself undertakes to pay all the usual tenant's rates and taxes with which the hereditaments or premises rented by the tenant are chargeable, together with tithe commutation rent-charge, the expense of upholding the buildings in tenantable repair, insurance against loss by fire, and any other expenses, if any shall exist, necessary to maintain such hereditaments in a state to command such gross rent. Net rent they defined as the amount which is received by or which remains clear in the hands of a landlord after all such taxes, charges, and expenses as are above enumerated shall have been provided for.

Acting upon these definitions, many surveyors included in their estimates of gross estimated rental the whole of the rates and taxes usually paid by the tenant. For example, in the case of a house worth £100 per annum to a yearly tenant, the rates and taxes upon which amounted to £20 per annum, and the average cost of insuring, repairing, and maintaining the property £20 per annum, they called the gross estimated rental £120, the rateable value £80.

So far as regards the mere payment of poor-rates, no injustice was done to the ratepayer; but, in the case of other uses made of the gross estimated rental, it became apparent that the intentions of the Legislature had been misunderstood; moreover, valuations so made seemed to estimate the value of property in a parish unfairly and unnecessarily high. It very early became the practice to disregard the instructions of the Poor Law Commissioners, and to omit all consideration of rates and taxes in making valuations; and, in 1859, the Poor Law Commissioners were advised by the then law officers of the Crown (Sir Fitzroy Kelly and Sir Hugh Cairns) that the term "gross estimated rent" meant the rent at which the property might be expected to let, the tenant taking the burden of rates and taxes and tithe upon himself. In other words, they were of opinion that the word "free" in the Statute must be considered as referring to rent and not to hereditaments.

An attempt was made in the Union Assessment Committee Act, 1862, to remove the doubts which had existed, but without much success so far as ordinary ability can comprehend it. Nevertheless, the opinion of the law officers in 1859 is now universally acted upon and generally understood.

It must always be borne in mind that the rateable value is not the actual rent at which a property may be let, but that rent at which, after taking all things into consideration, it might reasonably be expected to let. Moreover, it must be remembered that the circumstances to be taken into consideration in estimating the value must always have reference to the period at which the valuation is made.

A house which, on the completion of a railway or some other public improvement, will be worth £100 a year, may, at the present time, be worth only £50 a year. While it is worth £50 it must be assessed at that sum only; but, as soon as the improvement takes place, the assessment must follow the increased value. Again, the rent reserved in a lease may not be evidence of rateable value. A property may possess a gradually increasing value, extending over many years. A lessee, in agreeing to pay a fixed constant rent, would average those circumstances. The rate must be made on an estimate of the annual value from time to time—low when that value is small, and higher as it increases. Again, property may, from unforeseen circumstances, increase or decrease in value during the term of a lease. If it should increase, it would be unfair to the other ratepayers, who might not be similar lessees, if the assessment upon it were not increased; and, if it should decrease in value, it would be unfair to the lessee not to decrease the assessment. The term from year to year must not be misunderstood, as it sometimes is. It does not mean a letting for a year only, nor a letting on a yearly tenancy; but it means that changeable circumstances must be taken into account from year to year as they arise.

Valuation of Agricultural and Accommodation Lands.—In addressing the Institution of Surveyors, it is quite unnecessary to attempt to explain the mode of valuing agricultural or accommodation land. Nevertheless, it is well to again point out that the rateable value is not the rent actually paid either on a yearly tenancy or under a lease, but that it is the rent which, all things considered, a tenant might be reasonably expected to pay for the year next following the making of the valuation. The late Lord Denman, whose judgments were always as clear as it is possible for judgments to be, in delivering judgment in the case of a brick-field appeal, says: "It may well be that, although at the end of the year the lessee has made so many bricks that he can afford to pay £150 in royalty to his landlord, yet he could not prudently, at the beginning of the year, contract, at all events, to pay more than £100; and, if so, the latter rather than the former will be the sum at which the land may reasonably be expected to let from year to year."

In the case of accommodation lands, a piece of meadow land may be situated in the middle of another estate, and in front of the drawing-room windows of the occupier's house. It is reasonable to suppose that, in such a case, the occupier of the house would give more rent for the meadow land than its value for agricultural purposes would justify, and therefore it possesses a corresponding rateable value; but, if such land becomes by purchase a portion of the other estate, it then possesses no greater rateable value than the adjoining lands, of which, in fact, it has become part. Small pieces of land adjoining a town will often let at rents quite disproportioned to their agricultural value, and their rateable value is such a rent as they may, in that way, be reasonably expected to fetch, notwithstanding that exactly similar adjoining lands which form part of an adjacent farm can only be reasonably expected to let at their agricultural value.

The difference between the gross estimated rental and the rateable value of land is very small, and, in practice, it has hitherto, for the most part, been disregarded; but the Valuation (Metroplis) Act, 1869, fixes the allowance, in metropolitan districts, at 5 per cent., and therefore it is presumed that such an allowance will very generally be made in all places in the future. It may be mentioned that, in the case of lands subject to tithes, the amount of the rent-charge should be deducted from the estimates of both gross and rateable value, the tithe rent-charge being itself rateable as a separate hereditament.

Valuation of Houses.—The *gross estimated rental* of a house is that rent which a tenant might reasonably be expected to give for the right to occupy it for one year, assuming that the landlord bore the expense of insuring, repairing, and upholding it. The *net rateable value* is the rent which a tenant might be reasonably expected to pay, who took upon himself the expense of insuring repairing, and upholding it.

The *rent* is the rent to be expected for the year following the making of the rate, but the allowance for *repairs* is to be the probable average annual cost. To give but one instance: general painting, which occurs only once in seven years, is not to be allowed in the year in which it actually is done to the exclusion of all other years, but a fair average annual charge on account of it is to be taken. In addition to the allowance in respect of indispensable repairs, an allowance is to be made in respect of contingent or future renewals. In the case of *The Queen v. Wells* (L. R., Q. B. Cases, vol. ii., p. 548), the most recent decision upon this point, Lord Chief Justice Cockburn stated that there seems no distinction in principle between a sum annually laid by to make good, when it shall become necessary, an inevitable loss by the destructive agency of time, and a fund laid by for an indemnity against a loss by fire or storm, or other peril, insured against.

Valuation of Farm Homesteads.—In estimating the rateable value of farm homesteads, several matters have to be taken into consideration. For example: the buildings may be very much in excess of the actual requirements of the lands of a farm; but it is obvious that a tenant can only be reasonably expected to pay such a rent as the buildings which he actually requires would command. Even that rent may have to be diminished instead of increased, from the fact that the repairs and insurance of the larger buildings are more costly to the tenant than the repairs and insurance of buildings of the proper size would be.

It may, however, happen that the occupier of such a farm may also occupy, as a separate rateable hereditament, land, either wholly without buildings, or otherwise deficient in that respect, in which case the rateable value to him of the buildings previously alluded to will be increased.

Valuation of Trade Premises, Mills, Factories, &c.—In estimating the value of trade premises, such as a factory fitted up with machines, a foundry with furnaces and forges, or a brewery with fixed steam-engines and vats, the value of the machinery as enhancing the annual value of the freehold, of which it forms part, is to be taken into consideration.

An important decision in respect of the rating of mills was given in the case of *Staley and another v. Castleton* (33 L. J., M. C., p. 178). The mill was fitted to its full capacity with the machinery useful and necessary for a cotton-mill; a steam-engine was fixed for the purpose of turning the machinery, and steam-

pipes from the boilers were carried through all the rooms in the mill for the purpose of warming them. Some of the machinery was fixed to the floors in order to its steadier working, while, in the other instances, it was merely placed upon the floors of the mill. According to the custom of the trade, the machinery was in the nature of tenant's machinery or fixtures. Before the American war, the property had been of considerable annual value as a cotton-mill, but in consequence of the state of trade during the war the mill was closed. Nevertheless, the machinery was kept in it, and a man was employed to attend to the fires for the purpose of keeping up a proper degree of warmth, and to keep the machinery in a state of repair.

The court held that the mill was thus used as a storehouse for the valuable machinery that it contained, and was to be valued for assessment to the extent of the rent which it would command as such storehouse.

Following this decision came another important case, *Harter v. Salford* (34 L. J., M. C., p. 206). The appellant for many years carried on the business of a silk manufacturer; but, in 1863, he gave up business with the intention of never resuming it. The mill and premises were advertised for sale. The decision was that, although not in use as a mill, the buildings were to be valued as storehouses for machinery.

Hotels, refreshment-rooms, Epsom and other race stands, canteens, and similar trade premises, which, by reason of their special situations command rents in proportion to the extent of the trade which can be carried on in them and nowhere else, must be valued in connexion with their trade receipts—*i. e.*, from the gross receipts must be deducted the working expenses necessary to earn the receipts, allowances for trade profit to the tenant, for interest on the capital which he must necessarily employ, and for risks and casualties. The balance is the rent which he may reasonably be expected to be willing to pay to his landlord as rent.

In valuing all descriptions of house property, the question constantly arises —Is cost ever the measure of the rateable value of property? In giving his decision in the Mile End Old Town case, Lord Denman says: "The outlay of capital might furnish no criterion of the rent a property should yield, since such capital may have been injudiciously expended, and what was costly may have become worthless by subsequent changes." It should be observed that Lord Denman did not there say that cost was never the measure of value, and, obviously, it sometimes is. Assume, for example, that the guardians of a union are in want of a workhouse, and that some landowner within the union is possessed of a building exactly suited for such purpose, but that he requires a rent of £1000 a year for it. The guardians find, upon inquiry, that they can build a new workhouse and provide the land at a cost of £10,000, and that they can obtain the money at the rate of 5 per cent. per annum, which will equal a rental of £500 per annum. They elect to take the latter course and build the workhouse, the rateable value of which is £500 per annum, because that sum is the highest rental which it would be reasonable to expect them to give. Assume, however, on the other hand, that the landowner was unable to get a tenant for his building, for any purpose, at a higher rent than £250 instead of £1000 a year, and that he therefore would be willing to let it to the guardians at £250. In this case, the rateable value would be £250 per annum only, because it would not be reasonable to suppose that the guardians would pay for any other similar building a higher rent than that at which they had been able to take this from the landowner.

In estimating the rateable value of bridges, as in the case of railways, it does not follow that any direct receipts arise in the parish which is the subject of the valuation. The case of *The Queen v. The Hammersmith Bridge Company* is one in point. It was there held that, although the whole of the receipts were in the parish of Hammersmith, yet the bridge itself was the direct source of the rateable value, and that such net rateable value, when duly ascertained, was to be apportioned between the parishes according to the length of the bridge in each.

Valuation of Tithe Rent Charges.—The rateable value of a tithe rent-charge is the rent which a hypothetical tenant might be reasonably expected to give for it annually, such tenant having to pay the usual tenant's rates and taxes upon such tithe rent-charge, and to derive some remuneration for his time and attention in collecting it (*Queen v. Capel*).

In the case of a clergyman, whom by reason of the number of parishioners, and the value of the incumbency, the bishop of his diocese could compel to keep a curate, the reasonable salary of such a curate was, in the case of *The Queen v. Goodchild*, directed to be allowed; so also in the case of *The Queen v. Lamb*, where the duties of the incumbent were greater than one man could perform, the curate's salary was directed to be deducted; but this allowance for a curate has by the recent case—*The Queen v. Sherford*—been overruled, so that it must now be taken that such a deduction cannot be allowed.

Valuation of Coal Mines, &c.—Coal mines, brick fields, clay pits, slate quarries, &c., which involve the removal of portions of the soil, must be valued according to the rent and royalty which it is reasonable to expect the occupier would pay the landlord for that species of occupation. In the case of *The Queen v. Westbrook*, it was held that a royalty so paid must be considered as a portion of the rent.

Valuation of Saleable Underwoods.—Saleable underwoods must be valued at the rental at which they might reasonably be expected to let, according to the quality of the wood and the situation of the land.

The valuation of railways, gas and water works, involve considerations so special that the subject is reserved for a separate paper.

A NEW AND ECONOMICAL METHOD FOR EFFECTING THE EXTRICATION & CONDENSATION OF AMMONIA FROM GAS LIQUOR.

By Frederick Braby, F.G.S.

It is but a very few years since that the various bye-products obtained from the manufacture of coal gas were not merely a drug in the market, but proved an absolute nuisance to the manufacturer and to the general public.

Coal tar was even burnt under the retorts, or was introduced therein for the production of gas, and gas liquor was commonly given away to any one whose ingenuity might enable him to turn it to a useful purpose.

But the progress of science in this, as in other cases, soon discovered applications where none were supposed to exist.

From coal tar are not only now obtained naphtha, benzole, carbolic acid, and other valuable derivatives, but also the brilliant and diversified colours of what are called aniline dyes are obtained from the same source. The ammoniacal liquor, too—to which, on the present occasion, I desire to be favoured with your attention—is now not only not given away in the metropolitan and other districts, but in certain localities the greatest competition exists for its acquisition. It at present constitutes, in this country, the principal source of ammonia, and, consequently, of the ammoniacal salts, which are so usefully and so successfully applied in the arts, and more especially to agriculture. In London and its neighbourhood the purchase of the residuary products of the various gas companies is eagerly sought after, and it is now considered a privilege to be allowed permission to tender for them for the term of one, two, or more years supply. Practically, the tar and gas liquor trade is in the hands of a few parties jealously desiring to exclude outsiders, who thus find it extremely difficult and often absolutely impossible to obtain even a few thousand gallons.

The object of the present communication is to show how the demand for gas liquor, which so far exceeds the means of actual supply, can be met. It is to show, moreover, that, by condensation and reduction of bulk for transport, small and remote gas-works may be enabled to utilize and export their residual products at a profit; and, above all, how, by the introduction of certain improvements, the quantity of ammonia, as produced and utilized from the manufacture of gas, may be practically increased from ten to fiftyfold.

The strength of gas liquor is commonly specified in the various tenders as technically 6 oz. The prefix, denoting the number of ounces, refers to each gallon of the liquor, and does not signify the number of ounces of ammonia that are present, but the number of ounces of sulphuric acid which would be required to neutralize the ammonia; consequently a butt of 108 gallons of 6-oz. liquor implies, by calculation, that 108 times 6 ozs., or 40 lbs., of sulphuric acid are required to saturate the whole quantity. Now, it is found in practice that, if we divide the quantity of sulphuric acid required by 3, we shall get at the quantity of ammonia actually present. This result closely agrees with theory, the equivalent of dry ammonia being 17, and that of monohydrated sulphuric acid (oil of vitriol) being 49, the proportion is very nearly 1 to 3. It follows, therefore, that as 40 lbs. of sulphuric acid are required to saturate a butt of 6-oz. liquor, so one-third of this, or little more than 13 lbs. of real ammonia are contained in this immense quantity of liquid and merchantable product, weighing as it does, in the aggregate, no less than 1107 lbs., or half a ton. On referring to the ordinary commercial standard—viz., of 6 ozs. to the gallon—6 ozs. of sulphuric acid divided by 3 gives 2 ozs. of ammonia as the entire quantity present. Now a gallon of the gas liquor weighs 10 lbs., and if the pounds be multiplied by 16 to reduce them to ounces, we have a total of 160 ozs., containing only 2 ozs. of real ammonia, or 1 oz. to 80 ozs. of water.

The result of this is, practically, to prohibit the transport of gas liquor over any but moderate distances, because, in its present form, for every ton of real ammonia carried by barge, tank-cart, or otherwise, no less than 80 tons of water must be carried for no other purpose but as a solvent. It must not be inferred, however, that the *whole* of these 80 tons of water is waste carriage. Ammonia in a free state cannot be conveniently carried, except when dissolved in a certain quantity of water. It would not be judicious to concentrate the ammonia to a higher degree than ·900, since if, in course of carriage, it were subjected to any great degree of heat, the water at an elevated temperature would disengage some of the NH_3 held in solution, and such a disengagement of ammonia might be attended with dangerous results. A very useful and safe solution for all purposes of transit would be about one part, by weight, of ammonia to four parts of water; this would reduce the present cost of carriage for this important article to no less than twenty times, or, in other words, the transit of a certain quantity of ammonia over a certin distance costing now £20 would, if conveyed in the above concentrated form, be reduced to 20s. This scale of reduction would at once enable it to be carried by rail in petroleum or other barrels, or in tank-trucks, or otherwise, and would bring the numerous gas-works which are scattered over the United Kingdom within economical transport of the centres of manufacturing industry, so that this important bye-product of gas-making might be utilized for the general good, and be not so extensively wasted as has been, and is now, frequently the case.

In order to effect this desirable object, I recently, in conjunction with Mr. Baggs, secured a patent for effecting the necessary concentration of ammonia by certain novel means, which promise in practice to prove far more rapid and economical than any hitherto employed. The process may be shortly described as follows:—To the common ammoniacal gas liquor a certain quantity of slaked lime is added. The liquor thus treated is placed in a capacious boiler or still containing from 4000 to 5000 gallons. The whole is then heated and maintained at a temperature of from 100° to 200° Fahr., the liquor being slowly but constantly stirred by means of an internal agitator, the spindle of which passes through a stuffing-box in the end of the boiler. A powerful blast of air from a double-action force-pump actuated by a small steam-engine or otherwise, is blown continuously through the liquor. The air enters by two long perforated pipes placed near the bottom of the boiler, and in its upward passage it is compelled to pass through a horizontal diaphragm drilled with numerous small holes. The result of this arrangement being that the air, in its ascent, is subdivided into innumerable small sheaves and bubbles, to each and all of which, in accordance with well-known and recognized laws, the ammonia attaches itself, and is carried away with only a very small proportion of aqueous vapour. An exit-pipe is fixed to the top of the boiler, so as to carry away the mixture of air and ammonia, and the extremity of this pipe dips into a supply of water contained in a cold and suitable receiver, where the ammonia is immediately absorbed, and the air after thus effecting its removal in a separate state, escapes through the water and is permitted to pass off into the atmosphere. The condensers are generally arranged like a series of what are known as Woolfe's bottles, but for the purpose of obtaining great strength and purity, this arrangement may be superseded in the manner following.

The ammoniacal gas separated by the air is purified in a manner which will be afterwards described, and is then caused to pass into a vessel about three parts filled with broken lumps of pure block ice. From the well-known affinity of ammonical gas for cold water, the gas is arrested by the ice, which is rapidly liquefied, and a pure solution of ammonia of any required strength is obtained. It is advantageous to cool down the mixture of air and ammoniacal gas before it is allowed to enter the condenser; the air after having parted with the ammonia which has been dissolved by the liquefied ice, passes off into the atmosphere as in the former instance. The finest Norwegian transparent block ice may, in the height of summer, be obtained at the London Docks at 23s. per ton, and even less, according to the number of tons required, the supply being constantly maintained by the arrival of fresh ships. Or ice may be obtained by one of Siebe's refrigerating machines almost as cheaply as that which is imported.

This patent process for separating the ammonia by blowing air through gas liquor, when at an elevated temperature, is so much more rapid in the operation than the process of merely boiling the gas liquor as hitherto conducted, that, with a very moderate-sized apparatus, several thousand gallons of gas liquor can be treated in a single day, and the ammoniacal produce of the largest works may be continuously converted into a concentrated and more portable form without trouble or delay. Even in the smallest works, consuming not more than from ten to fifty tons of coal a week, the bulk and weight of the gas liquor may be quickly reduced, and the result will be of such standard value that a still containing from 20 to 100 gallons would probably, in such cases, answer every desired purpose, and would be found to be remunerative. In many instances the gas liquor might be heated, and the power supplied, if desirable, from the waste heat of the retorts.

By the adoption of this improved process the present trade in crude ammonia may be expected to expand and to become of higher importance than it now is.

The comparatively limited supply which is now available restricts its application. The commercial advantages which would be derived from the many technical purposes to which it is applicable would be considerable, and manufacturers being enabled to obtain cheap supplies from distant sources, the total quantity utilized would be immensely increased.

When, instead of producing caustic ammonia, it is desired to manufacture ammoniacal salts, the ammoniacal gas in conjunction with the atmospheric air may be conducted into sulphuric or muriatic acid, or into a metallic or saline solution capable of appropriating the ammonia.

As the evaporative power of air increases with the absence of moisture therein, it is possible that, by drying the same artificially before introducing it into the liquor, it would take up a great quantity of ammonia. The removal of all moisture from air may be effected with comparatively little expense by the suction of the air required for the force-pump through sulphuric acid, and a close wooden box containing lumps of chalk. This method is well known in connexion with other applications.

The blast of air may be hot or cold, and may be delivered in any manner

adapted to increase and effect more intimate contact between the air and the liquid containing the ammonia.

By adopting what I call the atmospheric or blowing principle, nearly the whole of the ammonia can be liberated from the solution in which it is contained, without any fire or external heat applied to or under the still or boiler, but, if the liquor be heated, the solubility of the alkaline gas is diminished and its extraction is facilitated.

Gas liquor is, in this country, the most common, and at the same time the most economical, source of ammonia, and the system of extraction by forcing air would, of course, be equally applicable to ammoniacal bone liquor, or to any other chemical preparation in which the caustic ammonia is held in solution.

The principles already indicated may, perhaps, be illustrated with advantage by a brief description of a working plant actually constructed at Deptford for the purpose of extracting ammonia. An excavation has been made in which is sunk a reservoir for containg the gas liquor, and having the following dimensions:—namely, 35 feet long, 7 feet wide, and 6 feet deep. The bottom is formed of one foot of concrete, two courses of bricks, and of two courses of red flat tiles; the sides are of 14-inch brickwork, two courses with tiles in conjunction with concrete.

The wrought-iron still is set in brickwork, so that flame may play more than half round its external surface. It is 30 feet long by 6 feet in diameter. About 4000 gallons of gas liquor are pumped into it from the reservoir for the purpose of being operated upon.

Heat is applied by means of a fire underneath, but a coil of hot air or steam pipes placed in the interior of the still or boiler would be equally efficacious. Two cast-iron 3-inch air-pipes, which are attached to the ammonia generator, extend along its whole length, and are situated one on either side, and nearly at the bottom. They are perforated with holes increasing in size as they extend from the inlet. Into these pipes, and from them into the gas liquor, is driven atmospheric air, by means of a pair of cast-iron force-pumps. These are 20 inches in diameter, 1 foot 8 inches stroke, with rods and slings, wrought-iron connecting rod and crank, and a cast-iron beam 6 feet long. On the entry of the streams of air they are caught and agitated by the twelve iron fans of a stirrer, making about 80 revolutions per minute.

The air, together with the lime and the various constituents of the gas liquor—viz., water, ammonia, carbonic dioxide, sulphuretted hydrogen, sulphocyanides, &c.—are thus brought continuously into intimate contact. The air loaded with the volatile alkali which has become eliminated from the solution passes upwards into the steam-chest, and through a branch-pipe into the purifier or washer. This is a small wooden vessel of the capacity of 350 gallons, containing lime, and being about one-third full of water. It has a tight head, and a stout perforated elm false bottom, the holes being concentric, and increasing in number and dimension as they radiate from the inlet, which is brought below the false bottom.

This purifying vessel is furnished with a small agitator having two blades, one revolving above and the other below the false bottom. There are two trial or test taps at appropriate heights, to test for gas or for water, and there is also a pipe sealed at one end, rather less than half way from the bottom, for the purpose of leading away any excess of liquid that may accumulate owing to the condensation of aqueous vapour which may pass over with the volatile alkali. There is a long straight tube or safety-pipe from the washer, and the bent pipe from the ammonia generator is also provided with a safety-valve and a vacuum-valve. In the washer the ammonia is deprived of any remaining hydrosulphuric acid or other impurity that may have escaped being fixed in the generator. About half a bushel of finely sifted slaked chalk lime is found to be a suitable charge for the washer, and when this becomes saturated or impure it is renewed by means of a pipe and tap placed at the bottom of the vessel. The washer being a close vessel soon becomes full of air and gas, which are forced by the pressure through a pipe opening into the top and leading to a coil or worm placed in a cold-water cistern, and terminating in a deep close vessel about one-third full of pure cold water, which has been condensed from the waste steam from the engine. A portion of the ammonia becomes absorbed by the water, but the residue, together with all the air, after bubbling up through the liquid, is conducted by a bent pipe to nearly the bottom of a second similar receiver, and thence in the same way to a third, but which is opened at the top.

The air, having fulfilled its function, is now permitted to escape into the atmosphere, the whole of the ammonia having, however, been arrested.

This last receiver, instead of water, contains a strong solution of chloride of iron, which, being denser and possessing a higher specific gravity than water, offers a greater pressure and resistance to the passage of the gas. The iron salt is, of course, decomposed, with formation of muriate of ammonia in solution, with deposition of a green mud containing sesquioxide of iron, which, after having been calcined, is found to constitute an excellent pigment for rough iron or woodwork.

After the whole of the ammonia has been extracted from the gas liquor, the contents of the still are run off into a draining pit, from which the clear solution finds its way into the sewers, and the solid inodorous lime compounds may be carted away.

This draining-pit is constructed of 1½-inch deal boards, together with sand and brickwork. It is 4 feet 9 inches wide, 5 feet 4 inches deep, and 10 feet long. There are fillets whereon to rest three perforated shelves or platforms. The bottom is formed of perforated deals, with 6 inches of sand, also with gravel and cement. There are channels and small drain-pipes leading into a large central earthenware pipe, and from thence into the sewer. The sharp sand, &c., under the perforated boards can be removed at will, and be replaced by fresh materials whenever required.

Care must be taken that the large pipe from the boiler to the washer be sufficiently high to guard against any back pressure. The vacuum-valve opens and admits air when the fire of the still is withdrawn and the steam becomes condensed.

In order to ascertain the exact state of the contents of the boiler at any required height, and to avoid tapping the upper portion of the boiler at too many places, the following simple contrivance is adopted:—There is one tap at the lower end, to which is attached a short pipe inside the still working easily on an elbow. To this pipe is connected a copper wire, having its outlet just above the external surface of the boiler, and by which wire the short pipe may have its orifice presented at any required height at which it is desired to ascertain the state of the contents of the vessel. For instance, supposing the fire to be withdrawn, and the agitators to be quiescent, if the end of the tube were pulled up by the wire and the tap opened, a clear liquid would issue, which could be tested in order to ascertain whether the whole of the ammoniacal gas had been removed. On the other hand, if the short tube were allowed to lay along the bottom of the still, the opened cock would allow the green sulpho-calcareous mud to escape. It is stated in Dr. Miller's "Elements of Chemistry" that, at a temperature of 32°, water takes up about 1050 times its volume of ammonia; at 59°, 727 times; and at 78°, 586 times its volume. Water saturated with ammonia at 60° contains more than one-third of its weight of the gas, increasing in bulk from 1·0 to 1·5, and becoming specifically lighter.

Hence the receiver should be not more than one-third or one-half full of water, to allow for the increase in bulk caused by the solution of the ammonia.

In July, 1867, valuable papers upon the utilization of the waste products of the manufacture of coal gas were read before that important body, the British Association of Gas Managers, by two of our first authorities on this subject, Dr. Letheby and W. Esson, Esq. Dr. Letheby declares that it is manifestly of the greatest importance that the liquor should be sent away to the gas-works as strong as possible; it ought, in fact, never to be under 6° Twaddle, or of less than 12 ozs. strength, and with proper condensation and judicious washing there should be from 29 to 30 gallons of such liquor produced from every ton of coals. The price in London is 2s. per butt, 8-oz., with an increase of 4d. per ounce on every additional ounce of acid strength. Below 3° of Twaddle or 5 ozs. of acid it does not pay for working, whereas at 10° or 11° of Twaddle it is a valuable product. Both Dr. Letheby and Mr. Esson emphatically insist upon the importance of the strength of the ammoniacal liquor. So rapidly does the commercial value augment, in relation to its concentration, that whereas a butt of 108 gallons of gas liquor is worth 4s., the same quantity of caustic ammonia of specific gravity ·900 is worth from £15 to £20. A lower strength of gas liquor than 6-oz. has not hitherto been thought worth working, but one advantage in Braby's system of extraction and concentration consists in the fact that a high strength is not indispensable. Even 2-oz. would in practice yield a profit.

As an evidence of the importance of an increased supply of ammonia and of its large demand, it may be mentioned that a firm with which the writer is connected recently offered 4s. per butt of 6-oz. liquor, and yet was unable to obtain a supply, showing that the value has doubled in the short space of two years. Mr. Esson describes an economical arrangement for the extraction of ammonia from gas liquor with the assistance of steam, and by an apparatus similar to a Coffey's still, but which is subject to the disadvantage that the noxious gas (sulphuretted hydrogen) is not simultaneously fixed or disposed of, and that at least 15 per cent. of ammonia is left in the liquor, which has afterwards to undergo the supplementary process of distillation with lime. The present ordinary method of making liquor ammonia is, as far as I am acquainted, from sulphate or muriate of ammonia, which is itself obtained from gas water. By Braby's process, liquor ammonia may be obtained much more quickly and economically from gas liquor direct.

There are many gas-works where ammoniacal salts are now manufactured; but it is suggested that, in new works, or at those where the gas liquor is not at present utilized, it would be preferable, in the event of the adoption of the principle herein advocated, that the ammonia after concentration, should be sent to the sulphuric or muriatic acid works, rather than that the acids should be sent to the gas-works. In metallurgy, it is found more advantageous to transport the calcined or partly prepared ores to the coal districts for smelting, rather than to take the fuel to the mines.

Barges fitted with tanks ordinarily employed in the conveyance of gas liquor contain from 3000 to 8000 gallons. A land journey of 12 miles with two horses for a load of 500 gallons in a tank-van now costs £1. By rail, the cost of freight is 1d. per ton per mile.

The advantages of the above-described system may be summed up as effecting a considerable economy in labour, time, and occupation of plant, together with the facility of extracting the whole of the ammonia from the gas liquor in a pure condition. A manufactory, previously consuming 10,000 gallons of gas-liquor per week, may now utilize 24,000 gallons, and at about half the expense of fuel of that formerly incurred.

The great interest of this subject in a chemical point of view, its high importance to the metallurgist and manufacturer, and the increasing value of ammonia to the farmer (with whom it is almost another name for fertility and abundance), must constitute my apology for having engaged so much valuable time in its consideration.

DR. FRANKLAND'S ANALYSIS OF THE METROPOLITAN WATERS IN APRIL, 1870.—"Royal College of Chemistry, April 30, 1870.—Sir, I have the honour to submit to you in the following table the results of the chemical examination of the waters supplied to the metropolis during the month of April. For the purpose of comparison, I append also the results yielded by the water supplied to the towns of Edinburgh, Gloucester, and Manchester, and by Thames water taken at London Bridge at low water on the 8th of December last, and at Battersea Bridge at low and high water on the 1st of March. All the waters supplied to London were clear and transparent when drawn from the companies mains. The water delivered by the Kent and New River Companies contained the smallest proportion of organic elements. Of the companies drawing from the Thames, the Southwark Company delivered water containing the least proportion of organic elements. The waters supplied to Edinburgh were clear and transparent, except that derived from Crawley Burn, which was turbid.

Companies.	Date and Place of Collection.	Temperature in Centigrade Degrees.	Total Solid Impurity.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Previous Sewage or Animal Contam. (Estimated).	Chlorine.	Total Hardness.
Thames.											
Chelsea.....	Ap. 19—Cab Rk., Horse Guards.	12·2	25·40	·119	·021	·000	·220	·241	1880	1·61	20·96
West Middlesex	Ap. 19—Cab Rk., Portland Road.	12·8	26·18	·111	·017	·000	·252	·269	2200	1·63	20·40
Southwark & Vauxhall..	Ap. 19—Cab Rk., St. George's Ch.	13·3	25·00	·121	·013	·000	·213	·226	1810	1·62	20·96
Grand Junction.....	Ap. 19—Cab Rk., Woodstock St..	11·4	26·00	·123	·015	·000	·220	·235	1880	1·62	20·14
Lambeth....	Ap. 19—Cab Rk., Lambeth Road.	12·7	26·02	·135	·019	·000	·216	·235	1840	1·63	21·48
Other Sources											
New River...	Ap. 19—Cab Rk., Totnhm. Ct. Rd.	12·5	24·90	·055	·008	·000	·247	·255	2150	1·50	20·14
East London.	Ap. 19—Slater's, Old Ford Road.	12·5	26·26	·103	·013	·000	·196	·209	1640	1·71	21·48
Kent.....	Ap. 19—Deptford Bdge. Police Sta.	11·7	40·46	·043	·008	·000	·443	·453	4130	3·13	28·58
Thames water, filtered..	December 8, 1869—Lond. Br., mid-str., at low wat.		34·3	·558	·085	·103	·351	·521	4040	2·60	25·25
	Mar. 1, 1870—Battersea Br., mid-str., at low wat.		30·64	·451	·060	·024	·493	·573	4810	1·75	25·85
	At high water		32·20	·476	·048	·075	·364	·469	3940	2·05	25·02
Edinburgh Waters.											
Crawley Burn	April 6, 1870.	7·2	9·94	·162	·012	·000	·053	·065	210	1·06	6·42
Comiston Wr		8·1	22·94	·029	·010	·001	·858	·869	8270	2·00	11·62
Swanston Wr		7·2	13·48	·067	·007	·000	·062	·069	300	1·26	10·08
Colinton Wr.		8·3	13·60	·053	·009	·001	·000	·010	0	·95	9·84
Gloucester ..	March 18, 1870—Glou. Wr. Sup.		24·82	·375	·042	·000	·026	·068	0	1·52	19·62
Manchester..	Jan. 29, 1870—Man. Wr. Sup.		5·74	·070	·007	·001	·000	·008	0	·80	2·48

"The Registrar-General, &c." "E. FRANKLAND.

ON A SIMPLE FORM OF PHOTOMETER FOR DETERMINING THE AMOUNT OF LIGHT REFLECTED BY METALLIC SURFACES AT DIFFERENT INCIDENCES.

By Ogden N. Rood, Professor of Physics in Columbia College.

[From the *American Journal of Science and Arts.*]

PART I.

The fundamental idea of many forms of photometer is based on the comparison of two illuminated surfaces placed in immediate juxtaposition, and the judgment of the experimenter is called on to decide when the brightness of these appears equal. If the difference of the two rival surfaces be considerable, the inequality will be perceived even by an unpractised eye, but as the disparity is diminished the observer becomes less confident, and, passing into a doubtful and dissatisfied frame of mind, is at one moment inclined to consider the balance as gained, and at the next equally certain that it has been lost. It hence follows that no photometer of this form is adapted for investigations at all aiming at a refined character.

Bunsen, to whom physics as well as chemistry is under so many obligations, employs in the instrument which bears his name another principle. Here it is not the equality in the brightness of two adjacent surfaces, but the actual disappearance of a "spot" on an illuminated ground, the powers of the observer being now taxed to a much less extent, as it is merely a question of the visibility or invisibility of the "spot." The great superiority of this latter principle is evident from the mere statement, and it only remains to investigate how the proposed advantage can best be realized in actual practice. It is, I believe, generally admitted by those who have used Bunsen's photometer, that with it the end proposed is only approximately attained, the "spot" never becoming absolutely invisible, but merely assuming what may be termed an appearance of maximum faintness. Dove* has proposed a form of photometer, the general idea of which is not unlike that of Bunsen; it consists of a compound microscope provided with a microscopic photograph on glass, which serves as the "screen," the intention being to illuminate it from both sides in such a way that the photograph should assume the same degree of brightness with its own border or ground, and hence become invisible after compensation. In a former number of this journal I described a form of photometer partly based on this suggestion of Dove's, and at the same time detailed a few rough experiments that were made by its aid. Since then I have followed up the subject, and have examined somewhat, with the help of a more refined apparatus, the practical application of the physical and physiological principles involved in its more perfect construction and use.

The microscope and microscopic photograph I dispense with, gaining thus not only in economy but also in delicacy, while the plan of employing a silver collodion film on glass was retained and proved of great value, and, as will be shown in the second part of this paper, the idea of a total disappearance of the "spot" was at length realized to the fullest extent, when the precaution of using an absolutely unvarying illumination was observed. I proceed now to describe the instrument, and will afterwards add some determinations that were made by its help.

Description of the Instrument.—"*The Screen.*"—If we take a plate of glass covered by an opaque preparation, with a surface of some reflecting power, but without polish, and laying bare a small portion of the glass—say 2-10ths of an inch square—and having backed it up by a plate of ground glass, illuminate it front and rear by two lights, it is evident that a mass of light will be reflected to the eye of the observer from the opaque pigment, while light coming from the second source will traverse the naked portion of the plate and reach the same destination. This second portion, or that coming from the "spot," will have commonly a greater or lesser degree of intensity than that *reflected* from the adjacent regions of the plate, so that we shall have either a bright spot on a dark ground, or a dark spot on a light ground, and an attempt to equalize the two illuminations, so as to effect the disappearance of the "spot," will be successful only under the following conditions:—

1. All portions of the "spot" must be equally illuminated, and it must have no texture—that is, must not perceptibly consist of minute grains mingled with others having a less or greater degree of brilliancy.

2. All those portions of the ground surrounding and in contact with the "spot" must be equally illuminated, and the texture of the ground must likewise be uniform.

3. The transition from the ground to the "spot" must be perfectly sharp and sudden, so that not the faintest border can be seen surrounding it.

4. If it be required to render the invisibility of the "spot" more than momentary, it is equally essential that the ratio subsisting between the two sources of illumination should be truly constant.

If either of the first three precautions be neglected, the disappearance of the "spot" becomes entirely impossible, while it is only by a peculiar arrangement of apparatus that the fourth can actually be realized. (See second part of this article.)

Screen.—A plate of colourless glass of good quality is coated with photographic collodion, and immersed for a few minutes in a solution of nitrate of silver ("bath"), as though it was the intention to take a picture ("negative"); it is then exposed for a minute or less to ordinary daylight, and a solution of photosulphate of iron poured over it. This produces a dense opaque deposit of silver in the substance of the film, when the plate is to be washed well in plain water and dried. Its surface will be of a grey tint, and will vary somewhat in its power of diffuse reflection according to the sample of collodion used. A small amount of light is also regularly reflected by the upper surface of the collodion film, and in using the plate it is always so placed that this latter portion shall produce no effect on the result. The collodion film is now removed neatly, by the aid of a needle, from a portion of the plate, so that a square with sides 2-10ths of an inch is laid bare, care being taken to leave the edges clean and well defined, in which there is no particular difficulty, provided the collodion was originally of the proper quality to cause it to adhere well. If the "spot" is made much smaller than the above-mentioned dimensions, it becomes an annoying object for observation, while, if it be larger, it is difficult to illuminate it uniformly. This plate is seen at P, in fig. 1, the collodion side being turned towards the eye of the observer, and the other side, except just opposite the "spot," covered by a coating of lampblack mixed with weak shellac varnish, so as to leave a black non-reflecting surface. At the distance of an inch from the collodion-plate there is fastened, parallel to it, a plate of colourless glass, G, finely ground on each side; this is destined to receive the light from L. If only one surface of the glass be ground, the texture becomes plainly visible, particularly when, as in the experiments detailed in the second part of this paper, the "spot" is magnified. Only so much of the ground-glass plate is allowed to remain bare as is necessary, the remaining portions on both sides are covered by black non-reflecting paper. Plates P and G are then, as it were, roofed over, and enclosed on all sides by a small well-fitting blackened case, destined to prevent the light from penetrating between them; and, finally, to guard against possible errors by reflection from the walls of the room, plate G is provided with a projecting blackened tube, which cuts off stray reflected light. P and G, constituting thus the screen, are fastened at the end of a pair of long parallel iron bars, B B, made like the ways of a lathe, and provided with a scale graduated in millimètres. The length of this iron frame is 6 feet.

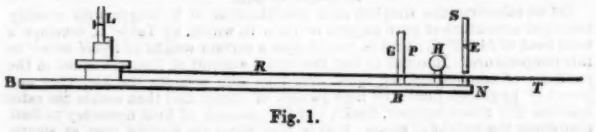

Fig. 1.

Source of Illumination.—At E is the eye of the observer, the face being protected from light by the blackened screen, S. E, the centre of the "spot," and the centre of the mirror experimented on, all lie in the same line, which is of course at the same time the axis of the instrument. At H are two small gas-flames issuing from circular apertures, and destined to illuminate the collodion-plate on the side next to the observer; both are fed from the same source. The gas-burner at H consists of two thin brass tubes, half an inch in diameter and one inch long, connected together by a glass tube; the circular apertures for the flames are placed at equal distances on either side of the "spot," and as far from it as is found most advantageous in any particular set of experiments; their distance from each other is 7 inches. The direct light from the two flames is prevented from reaching the eye through the observing aperture, by small blackened screens, the same means being employed to arrest it in its course towards L. If instead of two, only a *single* gas-flame is employed at H, the ground around the "spot" will be unequally illuminated, and exact observations become impossible. Of course the direct light from these two burners which penetrates through the "spot" must not be allowed to reach that portion of the ground glass opposite it; the distance of the flames apart must be so chosen that this becomes impossible.

The light from the moveable burner on the other side of the screen at L will be used direct and reflected. The small *single* moveable burner which supplies it is similar to those already described, and to it is attached a flexible india-rubber tube, which is supplied from the same source that feeds H; it is connected by a *wooden* column (for the sake of insulating the heat), to the arm, A, fig. 2.

I pass now to the joint support of the arm, A, and of the mirror to be experimented on. It consists of a block of brass, B, 4 inches square (see fig. 2, which is one-third of the real size); its under surface is cut in such a way as to fit the two parallel iron bars and to slide on them easily but steadily, and this foundation block is further provided with a vernier, V, to read off the distances on the millimètre scale. C is a graduated circle 6 inches in diameter, and is provided with a clamp at *d*. The hollow massive cylinder, *e*, supports the arm, A, and also carries the axis of the support of the mirror. The screws, 1, 2, 3, serve to bring the mirror into its correct position; it is pressed against them by a band of india-rubber attached to the edges of the mirror. It will be seen that, owing to this arrangement, all the different parts have motions quite independent, and yet by the clamping screws can at any moment be connected. Finally, attached to this stand is a long light rod of wood, R, reaching to the observer, and enabling him, by varying the distance between this moveable piece and the fixed screen, to effect compensation.

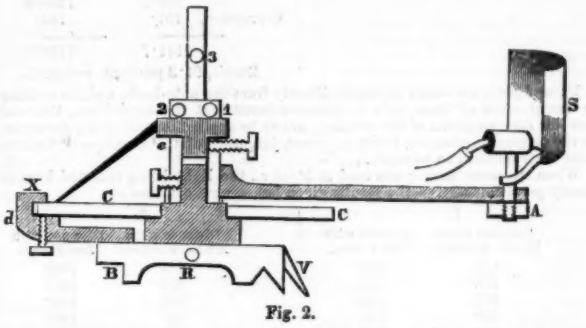

Fig. 2.

Flexible Gas-Tubes.—It occurred to me that, by splitting a stream of gas, and sending one portion to L (fig. 1), the other to H, it would be possible to secure a uniform ratio between the two illuminations, as it would seem that any cause which increased the pressure in one of the branches of the tube ought to be equally operative in the other, so that after a compensation had been effected it should be permanent. In practice this was not found to be the case; the compensation point gradually shifted its position in the course of the evening away from H, sometimes to the extent of 50 or 60 millimètres. This difficulty was remedied by a suggestion from Mr. Lewis Rutherfurd, who suspected that the trouble came from the unequal length of the two branches of the supply tubing; in point of fact, on giving them equal lengths and diameters, and making the compensations slowly, so that the branch attached to L was not much shaken or set in oscillation, this source of error became so greatly reduced as in no way to interfere with the observations.

Mode of Measuring the Amount of Light reflected from a Mirror.—To adjust the apparatus, it is first necessary that that diameter of the circle joining the 0° and 180° points should be made parallel to the axis of the instrument, which is effected by the use of the vernier at X (fig. 2); the circle is then clamped. Next, the vernier attached to the mirror is placed at 90°, and the mirror itself is made to assume a position at right angles to the axis of the instrument, by the aid of its three screws, and a small gas-flame placed on a support which rests on the parallel bars at a distance of 2 or 3 feet from the mirror, it being so contrived that the centre of this small flame shall just lie in the axis of the instrument. The mirror is adjusted till it reflects the light of this small flame back to the eye through the flame itself, securing thus the collimation with the desired accuracy. The arm, A, is then set at any desired angle with the mirror, and the two clamped together, when it is easy to arrange matters so that the reflected light shall be sent from the mirror along the axis of the instrument to the fixed screen at G. The small shade at S (fig. 2) prevents the *direct* light from reaching the same destination. After a compensation has been effected with reflected light, the arm, A, is made parallel with the axis of the photometer by the aid of its vernier, and another compensation is made with the *direct* light, the small shade being now placed behind the flame, so as to be out of the way and to prevent light from reaching the mirror.

Mode of Registering the Observations.—These were always registered with a sharp point on a slender fillet of paper, attached to the long wooden rod, R T (fig. 1), used for moving the mirror. This point was one end of a small lever placed at N (fig. 1). In consequence of this, at the end of a set of experiments two groups of dots were found on the paper, admitting of the most exact measurement on the following day. Before removing the paper from the rod two dots were always made on it in the neighbourhood of these groups, the corresponding positions of the vernier, V (fig. 2), being at the same time noted. A glass slide, ruled with millimètre lines, was then to be placed over the detached fillet of paper, and the observations recorded in the note-book. In the determinations given below, the observations on the direct and reflected light were made alternately, so as to avoid errors due to the shifting of the compensation point.

* Pogg. Annalen, Band cxiv., p. 145.

Observations on the amount of light reflected by a glass plate silvered by Liebig's process, the *silver* side being used. The light was reflected at an angle of 45°:—

1.		2.	
Distance when Mirror was used.	Distance with free Flame.	Distance when Mirror was used	Distance with free Flame.
946	1227	936	1286
949	1301	940	1287
950	1302	941	1288
951	1302	942	1288
952	1304	943	1290
955	1305	944	1292
956	1306	946	1292
957	1308	946	1293
958	1309	947	1295
961	1309	948	1296
961	1310	949	1297
962	1312	950	1298
965	1312	952	1298
966	1315	953	1301
967	1318	954	1303
967	..	955	1303
		956	1304
		958	1305
		959	1307
		960	1307
		961	1307
		962	1308
		965	1312
		..	1312
		..	1312
		..	1315
16)15323	15)19610	28)21867	26)33796
957·68	1307·3	950·7	1299·8
Correction, 191·	105·	Correction, 191·	105·
1148·68	1202·3	1141·7	1194·8

Result, 91·26 per cent. reflected. Result, 91·3 per cent. reflected.

These figures are taken of course directly from the note-book, and, in making an examination of them, it is to be remembered that the corrections, 191 and 105 (for false positions of the vernier), are to be applied to each of the distances in the respective columns, before a correct judgment of the closeness of individual observations can be made.

When the same mirror was used at 5°—*i. e.*, the light being reflected from it nearly perpendicularly—the results given below were obtained:—

1.		2.	
Distance when Mirror was used.	Distance with free Flame.	Distance when Mirror was used.	Distance with free Flame.
955	1297	954	1298
958	1304	955	1301
958	1304	956	1302
958	1305	957	1303
960	1305	957	1303
962	1307	958	1304
962	1308	958	1305
963	1310	961	1306
963	1310	961	1307
965	1313	962	1308
965	1313	962	1308
969	1313	963	1309
970	1314	963	1310
971	1314	964	1312
972	1315	965	1312
973	1318	967	1313
977	1318	968	1315
977	1328	969	1316
980	..	972	..
983	..		
983	..		
21)20624	18)23596	19)18272	18)23532
967·8	1310·8	961·6	1307·4
Correction, 191·	105·	Correction, 191·	105·
1158·8	1205·8	1152·6	1202·4

Result, 92·35 per cent. reflected. Result, 91·88 per cent. reflected.

In the second part of this paper I shall detail the results of several sets of experiments made with a truly constant illumination—in other respects, the mode of experimenting being quite similar to that used in obtaining the above results—when it will be seen that about two-thirds of the scattering in the figures was due to the shifting of the compensation point during the experiments, and not to any defect in the screen.

In the same way experiments were made on another mirror silvered by Liebig's process, the glass side being used, with the result that, out of 100 rays, 78·01 were reflected, the angle being 45°; while an amalgam mirror, tested at the same angle, reflected only 44·58 per cent.

INVESTIGATION OF FLAME TEMPERATURES, IN THEIR RELATIONS TO COMPOSITION AND LUMINOSITY.

By Professors B. Silliman and Henry Wurtz.

[Read to the American Association, at Salem, August, 1869.]

First Memoir.

CALORIFIC POWERS OR EFFECTS OF GASES.

These subjects lie, in our belief, at the very basis of the true theory of the phenomena of luminiferous gases, and have practical bearings that can scarcely be overrated.

In fact, our studies of the subject have led us in the direction of the general conclusion that, all other conditions being equal, the *temperature*, in a given flame, is the main factor of luminosity. This, however, may as yet be regarded merely as an hypothesis, in consequence of the imperfection of our present means of actual experimental demonstration of the temperatures of flames. It is an hypothesis, nevertheless, which is in general accordance with known facts. By the spectroscope, for example, which can recognise only luminous rays, we find that the higher the temperature the greater the number of these luminous rays. The recent results of Frankland upon the development of luminosity by increased pressure, in flames which are non-luminous under atmospheric pressure, are in accordance with this view, increase of temperature necessarily following increase of pressure.

Very vague views have been rife, even among chemists, with regard to the temperatures of luminiferous flames. Some have been satisfied with believing crude hypotheses, such as that the heat power of a flame is always proportional to the *density* of the gas or vapour undergoing combustion; or that it is proportional to the *amount of oxygen consumed* by a given volume of gas; and so on. This latter hypothesis has been one of very common acceptation. A view which is even now entertained by some skilful chemists (than which, however, nothing, as will be shown below, could be more fallacious) is that those individual gaseous compounds which impart the highest luminosity under ordinary conditions are also the most productive of heat.

The admirable researches of the great gas chemist, Bunsen, of Heidelberg, placed in our possession, some years ago, the means of computing, at least with approximate accuracy, the heat of flames of gases of known compositions; few, however, have properly and successfully applied Bunsen's methods in practice. We consider it quite time that these methods should be introduced to the knowledge of gas engineers in forms available to them.

Bunsen's formulæ for these computations are based upon the actual experimental determinations of the *total* amounts of heat developed by the combustion of different pure combustible gases with pure oxygen, made by Favre and Silbermann, and upon Regnault's determinations of the specific heats of gaseous products of combustion.

It is not to be maintained that Favre and Silbermann's numbers are strictly correct, but they are doubtless approximate, and at least proportionally correct among themselves. At any rate, they are the best data we have. Those employed here are included in the following table. They are usually given in the text-books for equal *weights* of the gases, but we have reduced them to the standard of equal *volumes* also, as more suitable to our present purpose. This reduction is made simply by multiplying the equivalents for weights by the densities, as given in the third column.

Table I.

	Total Calorific Equivalents. Of Equal Weights.	Of Equal Volumes.	Densities on Scale of Hydrogen = 1.
Hydrogen	34,462° C.	34,462° C.	1
Carbonic oxide	2,403° C.	33,642° C.	14
Marsh gas	13,063° C.	104,504° C.	8
Olefiant gas	11,858° C.	166,012° C.	14

The meaning of this table is simply that equal weights of water would be heated by the several gases to temperatures proportional to the numbers in the first column, when equal *weights* of the gases are burned; and proportional to those in the second volume, when equal *volumes* are burned.

A cursory glance at the figures in the second column of this table might seem to justify the notion hitherto entertained by many of the comparatively low calorific powers of hydrogen and carbonic oxide; and it was doubtless as a consequence of such a comparison as this that statements have been put forth and widely accepted among American gas engineers, to the effect that the weight of water heated from the freezing to the boiling point by one cubic foot of the four main components of illuminating gas, respectively, is as follows:—

Hydrogen	2·22 lbs. water.
Carbonic oxide	2·16 „ „
Marsh gas	6·17 „ „
Olefiant gas	10·74 „ „

The figures here being obviously about in the same ratio as those in the second column of Table I. Several most grave errors, however, are here involved. To get at the true relative calorific effects of the above gases, when burned in the open air, in heating water, below its boiling-point, deductions must be made, not only for the *specific heats* of the products of combustion of the gas, but also, more important still, for the *specific heat* of the *nitrogen of the air* required to burn the gas. In fact, when we consider that for each volume of oxygen required to burn a given volume of a gas, about *four volumes* of nitrogen must be heated up to the temperature of the flame, it becomes easy to conceive, what is actually the fact, that within certain limits the waste of heat due to this cause alone counterbalances altogether the advantage that would be supposed to result from the crowding of combustible matter into so condensed a form as in the illuminating hydrocarbons. An inevitable result of our investigations of this matter is that the heating powers of the flames of pure hydrogen and pure olefiant gas, even when used to the greatest advantage, to heat water below its boiling-point, are almost or quite identical.

[The term *specific heat*, as here applied to gases, may probably receive with advantage to some of our more practical readers, a few words of preliminary explanation. Gases, like all other bodies, differ in the amount of heat, so to speak, required to bring them to the same temperature. It is known in a general way to most persons that different *metals*, for example, differ much in this respect; and that if bars of iron, silver, and gold of the same size be put into the same fire, the iron will take about three times as long as the gold, and twice as long as the silver, to reach the same temperature. It is the same with different gases; and as the *time* occupied in the combustion is constant for all the products of combustion, the amount of heat-energy absorbed, or, in other words, the amount of diminution of the temperature of the burning mass, must differ according to the means of the specific heats of the products of combustion.]

In this discussion we have occasion to use the numbers representing the specific heats of but *three* gases, the three, namely, which remain after complete combustion—*steam*, *carbonic acid*, and *nitrogen*; as we must assume that in the hottest and most luminous zone or shell of the flame, there is no oxygen in excess to be heated. These three numbers are, according to Regnault's latest determinations, for equal weights of—

Steam	0·4805
Carbonic acid	0·2163
Nitrogen	0·2438
(*Liquid water* being	1·0000)

This means that the amounts of heat which would raise one pound of water and steam *to the same degree* are in the ratio of 0·4805 for the pound of steam, and 1 for the pound of water.

CALCULATION OF THE CALORIFIC EFFECT OF HYDROGEN BURNING IN AIR.

Let us take first the simplest case possible, that of hydrogen with exactly the right admixture of pure oxygen to burn it, which, by Table I., develops a total heat of 34462° C.; that is, would heat a certain weight of *liquid water* to this temperature. In order to find the actual amount of heat contained in the products of combustion, we must first take into account the fact that one pound of hydrogen burns to *nine pounds* of steam, and then obtain the ratio between the above number, 34462, and the amount of heat necessary to heat nine times the weight of steam; that is, nine times the specific heat of steam. Calling the total residual heat in the produced steam x, we have the simple proportion—

$$2 \times (\text{Sp. heat of steam} = 0{\cdot}4805) : 34462 :: (\text{Sp. heat of water} = 1) : x;$$

$$\text{or, } x = \frac{34462^\circ}{4{\cdot}3245} = 7969^\circ \text{ C.}^* = 14376^\circ \text{ F.};$$

* Bunsen, in his "Gasometry" (English edition of 1857, p. 242), gives this number as 8061° C., the difference being due to the use by him of a different number for the specific heat of steam—namely, 0·475, apparently an earlier determination of Regnault. Bunsen makes here the singular oversight of regarding this figure as the temperature, when "the gases can freely expand, as is the case in an open flame," overlooking the correction necessary in this case for the *latent heat of steam of combustion*, as is explained in the text above.

a number which, we may add, represents the maximum of heat capable of being imparted to *liquid water* by the flame of Hare's oxyhydrogen blow-pipe.

Still, we have by no means here the actual temperature of the free or open flame of Hare's blow-pipe, which is generally *lower* than this figure; as we have not yet taken into account the "latent heat," or heat of vaporization, of the 9 lbs. of steam formed. The Centigrade temperature necessary to convert 1 lb. of water into steam being 537°, to get the *actual temperature* of the oxy-hydrogen flame, we must modify the above equation, so that—

$$x = \frac{34462° - (9 \times 537°)}{4{\cdot}3245} = 6851° \text{ C.} = 12364° \text{ F.};$$

which is the temperature actually possible in the flame of the compound blow-pipe, *were the combustion instantaneous and complete.*

When hydrogen gas burns *in air*, however, as has been before stated, another deduction of enormous amount must be made from the above figures, due to the heat required to expand the nitrogen. This is obtained simply by adding to the divisor, as above, the weight of the nitrogen of the air employed, multiplied by its specific heat. The weight of the nitrogen in air = 3·318 times the oxygen; so that the latter of the above equations becomes—

$$x = \frac{34462° - (9 \times 537°)}{4{\cdot}3245 + (8 \times 3{\cdot}318 \times 0{\cdot}2438)} = 2744{\cdot}5° \text{ C.} = 4972° \text{ F.};$$

[We wish to point out that we have here a full explanation of the extraordinary rate of degradation of illuminating gas by admixture of air, which we have discussed elsewhere. The nitrogen of such air is not merely a diluent, or even a mere deductive quantity; its specific heat is an actual *divisory* function in diminishing the flame temperature.]

This, then, is the actual temperature to which the flame of hydrogen gas burning in the atmosphere might attain to, supposing complete and instantaneous combustion. If it is desired to obtain instead the total calorific effectiveness, as in heating water below its boiling-point—in which case the latent heat of the steam of combustion becomes also available—the above expression is changed by simply omitting the subtrahend in the numerator—

$$x = \frac{34462°}{44{\cdot}3245 + 6{\cdot}4714} = 3192° \text{ C.} = 5778° \text{ F.}$$

CALCULATION OF THE CALORIFIC EFFECT OF CARBONIC OXIDE BURNING IN AIR.

As the product of combustion is here solely carbonic acid, no latent heat of steam enters, and the calorific effectiveness is the same, under all circumstances, in air. In the numerator we substitute, of course, the calorific equivalent of one volume of carbonic oxide from Table I.; and in the denominator, for the specific heat of 9 lbs. of water, that of 22 lbs. of carbonic acid, being the weight of the latter formed by the combustion and combination of 14 lbs. (weight of a volume of carbonic oxide on the hydrogen scale by third column of Table I.) of carbonic oxide, with 8 lbs. of oxygen. The number for the specific heat of nitrogen is the same as before; and the equation is now—

$$x = \frac{33642°}{(22 \times 0{\cdot}2163) + 6{\cdot}47 = 11{\cdot}23)} = 2996° \text{ C.} = 5425° \text{ F.}$$

MARSH GAS AND OLEFIANT GAS.

In these two cases we have, as products of combustion, both carbonic acid and water, and therefore, when the calorific effects are sought for, we have not only the latent heat of steam entering as a subtrahend into the numerator, but also into the denominator, as divisors, all three of the specific heats of steam, carbonic acid, and nitrogen.

Then, as 8 lbs. of marsh gas consume 22 lbs. of oxygen, and produce 22 lbs. of carbonic acid and 18 lbs. steam; and as 14 lbs. of olefiant gas consume 48 lbs. of oxygen, producing 44 lbs. of carbonic acid and 18 lbs. of steam, the equations for the calorific powers of their flames in air become—

For marsh gas:

$$x = \frac{104504° - (18 \times 537°)}{(18 \times {\cdot}4805) + (22 \times {\cdot}2163) + (32 \times 3{\cdot}318 \times {\cdot}2138)} = 2414° \text{ C.} = 4386° \text{ F.}$$

And for olefiant gas:

$$x = \frac{166012° - (18 \times 537°)}{(18 \times {\cdot}4805) + (44 \times {\cdot}216) + (48 \times 3{\cdot}318 \times {\cdot}2438)} = 2143° \text{ C.} = 4970° \text{ F.}$$

When the deduction for the latent heat of the steam of combustion is not made, the results in these two gases are considerably higher, as will be obvious from mere inspection of the formulæ.

We shall now give, in tabular form, all the results of our calculations of the calorific powers, when burning in the air, of the four gases we have to deal with.

TABLE II.

For Equal Volumes of the Gases Burning in Air.	Calorific Effects in Heating Liquid Water. Cent. Deg.	Fahr. Deg.	Calorific Effects above 100° C. Cent. Deg.	Fahr. Deg.
Hydrogen (Sp. heat HO = ·4805)	3192	5778	2744	4971
Hydrogen (Sp. heat HO = ·4750)	3204	5799	2755	4991
Hydrogen (Mean)	3198	5788	2749	4980
Carbonic oxide	2996	5425	2996	5425
Marsh gas (Sp. heat HO = ·4805)	2660	4820	2414	4386
Olefiant gas " " "	2916	5451	2743	4970

COMPUTATION OF CALORIFIC EFFECTS OF MIXED GASES.

The above table renders the calculation of the calorific effects of any given gaseous mixture, whose centesimal composition is known, a matter of extreme simplicity. It is only necessary to obtain the sum of the multiples of the per centage of each component gas into its calorific capacity, as given in this table, and divide by 100.†

To serve as examples of these modes of computation, we here cite, in tabular forms, the results of some analyses of a number of gaseous mixtures, made by us during the past winter (1868–9). [These analytical results, it may be remarked, possess points of novelty and importance, both scientific and practical, which will bring them up again hereafter, in other connexions. They are here placed on record.]

Table III. gives the results of two analyses of gaseous mixtures obtained by passing steam *superheated to incandescence* upwards through a mass of *anthracite coal* heated to a high degree in a clay retort of a novel construction, according to what is now known as the "Gwynne-Harris," or American Hydrocarbon Gas System. In this table the results are calculated without carbonic acid and sulphuretted hydrogen, which, with traces of nitrogen and sometimes of oxygen, are found in the unpurified anthracite gas.

† Professor Bunsen, in the masterly discussion of the subject presented in his "Gasometry," not having in view the exact object we propose, has used a train of reasoning and a mode of formulation of some complexity, to follow which requires some little mathematical skill—part of his objects having been to construct a formula so general and comprehensive as to cover the direct computation, from any gaseous mixture independently, of its special calorific intensity. We have here aimed at so simplifying as to bring the whole subject within the capacity of all. Our above tabulation of the individual gaseous components, as a starting-point, seems to us to accomplish this most effectually, so far as illuminating gases are concerned.

TABLE III.

Analyses of Anthracite Hydrocarbon Gas, by Silliman and Wurtz.

	No. 1.	No. 2.	Mean.
Hydrogen	60·43	59·32	59·87
Carbonic oxide	35·44	37·14	36·29
Marsh gas	4·13	3·54	3·84
	100·00	100·00	100·00

In Table IV., column 1 gives the results of the analysis of the street gas served out at this period by the New Haven Gaslight Company, made from Westmoreland coal, enriched with about 6 per cent. of Albertite. Column 2, the mean of four analyses of the completed hydrocarbon gas made by us at Fair Haven during the same time, by combining gas from the same Westmoreland coal (with 10 per cent. of Albertite) with half its volume of the anthracite gas. Columns 3 and 4 are obtained from 1 and 2 by centesimal reduction, after deduction of the illuminant ingredients, being what we propose to designate as the non-illuminating *substrata* of illuminating gases.

TABLE IV.

Gas Analyses, by Silliman and Wurtz.

	(1) New Haven City Gas.	(2) Fair Haven Hydrocarbon Gas.	(3) Substratum of New Haven Gas.	(4) Substratum of Fair Haven Gas.
Hydrogen	43·58	46·77	46·79	50·27
Carbonic Oxide	2·14	9·56	2·31	10·27
Marsh Gas	47·42	36·71	50·90	39·46
Illuminants	6·86	6·96	..	..
	100·00	100·00	100·00	100·00

Table V. gives the results of the computation, from our formulæ, of the calorific powers of these five gaseous mixtures, for communicating temperatures both above and below that of aqueous ebullition. We should remark that we have here been obliged to regard the volumes of *illuminant hydrocarbons* as representing olefiant gas solely; both because we have no certain data as to their real nature, and particularly because, if we actually knew, or should assume, the nature of the hydrocarbon vapours present, still we have no experimental calorific equivalents, as we have for olefiant gas, from which to start in such a computation. We have reason to believe, nevertheless, that the errors thus introduced are not important in amount.

TABLE V.

	Weights of Water equally Heated below Boiling, by equal Volumes.	Weights of Water equally Heated above Boiling, by equal Volumes.	First Column reduced to New Haven Gas = 100.	Second Column reduced to New Haven Gas = 100.
Anthracite Gas	3100	2823	104·2	109·2
Substratum of the New Haven Street Gas	2917	2581	98·1	99·6
Substratum of the Fair Haven Hydrocarbon Gas	2962	2640	99·6	102·0
New Haven Gas, with the Illuminants assumed = Olefiant	2974	2592	100·0	100·0
Fair Haven Gas, with the Illuminants assumed = Olefiant	2959	2647	99·5	102·1

CONCLUSIONS.

Some of the practical conclusions to which we are of necessity compelled, by the results of the above investigations, are somewhat remarkable, so that we feel diffident regarding them. It is, however, always safe to follow the leading of Truth, however astray she may conduct us from our preconceived notions.

From Table II. it is apparent—

1. That of all known gases, the highest calorific effects, under ordinary atmospheric conditions, are obtainable from *carbonic oxide*, whose calorific value, above 100° C., is about 3000° C.

2. That in absolute calorific value, below 100° C., in the atmospheric medium, *hydrogen* surpasses its volume of any other gas, giving a temperature of about 3200° C.

3. That for all modes of application—that is, for producing both high and low temperatures—the total maximum calorific effectiveness of carbonic oxide is a *constant quantity*.‡

4. Compound condensed submultiple volumes of hydrogen, like that in marsh gas, have much *less* total calorific value in air than their volume of free hydrogen.

5. Condensed compound submultiple volumes of gaseous carbon, like that in olefiant gas, have no greater total calorific value, in air, below 100° C., than their own volume of carbon gas in the form of carbonic oxide; while above 100° C. their value is even considerably less.

PRODUCTS OF DISTILLATION OF COAL TAR WHICH BOIL AT A HIGH TEMPERATURE.—C. GRAEBE and C. LIEBERMANN.—The authors state that they obtained from a tar distillery at which the distillation is pushed till a coke only remains, a solid, lemon-yellow coloured fatty-looking material, fusing at 150°, while its boiling-point is higher than that of mercury. This material was soon recognised by the authors to be a mixture of various substances, but chiefly made up of chrysen, which, after having been purified, was found to fuse at from 245° to 248°, and difficultly soluble in alcohol, ether, and sulphide of carbon, a little more readily soluble in boiling anhydrous acetic acid and in benzol. The authors have studied, also, some of the products of oxidation of chrysen, and among these a body called chrysochinon (C_{18} H_{10} O_4). The formula of chrysen is C_{18} H_{12}.—*Chemical News.*

REVIVIFICATION OF THE OXIDES OF IRON EMPLOYED IN GAS-PURIFIERS BY MEANS OF STEAM.—C. MENE.—From the author's description it appears that, at the Vaise station of the Lyons Gas-Works, the following process is applied for regenerating the oxide of iron. The oxide of iron, saturated with sulphur as it

‡ Metallurgists, especially, will appreciate the suggestive import of the truths presented under the first and third heads, here enunciated, as we think, for the first time. It is to be noted that all the above effects belong to the maximum kind, and, of course, reach their development only under the most favourable conditions in each case respectively.

is taken from the purifiers, is placed in a tank made of iron, which, after having been filled, is hermetically closed. A pipe from a steam-boiler admits steam in the middle or bottom of the tank, while at the top thereof another pipe leads into the chimney-stalk of the boiler furnace, carrying off the sulphuretted hydrogen resulting from the action of the steam (low pressure) upon the sulphide of iron. Actual decomposition of water takes place in this process, its hydrogen combining with the sulphur, and its oxygen reproducing the peroxide of iron. The great advantage of this process is the very considerable saving of time and the space required for exposing the peroxide to the action of the air—a slow process. —*Chemical News.*

AN ILLUMINATING DISC.—Under this name, M. C. Bary has patented an invention intended to increase the illuminating power of gas, &c. The apparatus is simply a thin disc of some incombustible material—glass, porcelain, or metal—which is pierced with one or several holes, the apertures or aperture being proportioned to the diameters of the different burners. The size of the pierced disc may be the internal diameter of the chimney, so that it may be fixed at the upper part; or it may be a little larger, so that it may be placed directly upon the chimney.

SAN PAULO GAS COMPANY.—It is stated that the caution-money for the concession granted to the San Paulo Gas Company was transmitted by the last steamer to Brazil, and that a contract for the works has been arranged with a firm in Birmingham. Also that Mr. Thomas Rumball, C.E., who completed the Buenos Ayres Great Southern Railway, has been appointed engineer. He is also the engineer for the Parà Gas Company.

A NEW PHOTOMETER.—A photometer, invented by M. Nagant, is based upon the formation of a column of liquid, partially opaque, which may be drawn out until the length is such that the light from an illuminating body ceases to be visible through the liquid. The length of the column, which completely obscures the light, starting from the point where the column is thinnest, gives a measure of the intensity of the light under examination.

AVERAGE COMPOSITION AND QUALITY OF THE METROPOLITAN WATERS, APRIL, 1870.—The following are the returns of the Metropolitan Association of Medical Officers of Health:—

NAMES OF WATER COMPANIES.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Comps.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	17·97	0·050	0·092	0·001	14·8	3·8
West Middlesex	19·63	0·050	0·110	0·000	15·0	4·1
Southwark and Vauxhall	18·47	0·046	0·079	0·002	15·0	4·0
Chelsea	18·53	0·054	0·067	0·001	15·0	4·0
Lambeth	19·03	0·064	0·067	0·000	15·1	4·0
Other Companies.						
Kent	27·13	0·007	0·151	0·000	21·2	5·1
New River	18·07	0·021	0·110	0·000	14·6	4·0
East London	20·17	0·043	0·092	0·000	14·9	4·1

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and, in the case of the metropolitan waters, the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Association of Medical Officers of Health, 96,809,161 gallons; and the number of houses supplied was 477,184. This is at the rate of 30·5 gallons per head of the population daily. The last official return from Paris stated that the average daily supply per head of the population was 25·7 gallons; but this includes the water used for the public fountains, and for the ornamental waters in the Bois de Vincennes and the Bois de Boulogne. HY. LETHEBY, M.B.

Register of New Patents.

1196.—WILLIAM HENRY SMITH the younger, of 19, Salisbury Street, Strand, W.C., for "*Improvements in lavatories, and in taps, valves, and fittings to be used in connexion therewith for regulating the admission and discharge of water, which taps and valves are also applicable to other purposes.*" A communication. Provisional protection only obtained. Dated April 19, 1869.

These improvements consist in so mounting and fitting the basin that, by turning it partially round, it is caused to rise or fall, and either close or open the discharge or escape passages, instead of employing the ordinary description of plug and shell, tap, or cock, for regulating the admission of water.

1209.—WILLIAM EDWARD GEDGE, of 11, Wellington Street, Strand, in the co. of Middlesex, patent agent, for "*An improved water-meter.*" A communication. Patent dated April 20, 1869.

This apparatus is made of bronze, copper, or any other metal or alloy non-magnetic—that is to say, having no influence on the magnetized needle. It is composed of an annular vessel or basin, which may be perfectly closed by means of a lid, also annular. The basin and its lid both carry lugs, which come opposite each other, and are tightened together by bolts. The lid is provided with two pipes, one of which, inclined on the lid, is the adjutage by which the liquid arrives in the apparatus, and flattens and spreads out as it approaches the lid, through which it passes by a rectangular opening occupying the entire breadth of the annular vessel; the other pipe is circular, and spreads in the valve-box, reassuming a circular form at its upper part. The valve-box carries a wing-valve made in two parts, united by a joint, and it is by this second adjutage that the liquid escapes. Within this annular basin are two magnets and a series of wood or cork floats tied together by wooden sectors, so as to form a rigid whole of the same density as the liquid. This arrangement may be replaced by another, in which the two magnets are bound to a circle of metal or other floats forming a solid whole of the same density as the liquid. On the entire circumference of the above arrangement, which is termed the "parideuse," are small rods, which, while the meter is not acting, abut against one of the wings of the valve, which plunges to a certain depth in the annular basin. This valve has a cylindrical part provided with two small semicircular orifices, intended to permit the passage of water only when the valve has risen the entire height of this grooved cylindrical part—that is to say, when the large wing no longer dips in the annular basin.

1242.—GEORGE GRAINGER TANDY, of Anerly Road, Penge, Surrey, gentleman, for "*Improved apparatus for carburetting air or gas.*" Patent dated April 22, 1869.

The carburettor is divided into two parts, consisting of an upper a and lower chamber. The upper chamber contains the body of the liquid, and the lower one that portion which is being taken up by the gas or air passing through the chamber. The object of this arrangement is that the gas or air shall be uniformly impregnated with the liquid, which shall be supplied from time to time from the reservoir above.

The apparatus consists of a box having a horizontal diaphragm or partition from one inch to two inches from the bottom. On the lower or under surface of this partition is formed a double or single spiral, or a series of zig-zag, serpentine, or convolute passages, so as to make the gas or air travel for a considerable distance in contact with the liquid. From the under surface of the horizontal diaphragm wicks made of cotton or other absorbent material may be suspended so as to hang down into the liquid in the lower chamber; or, instead of the wicks, the space between the horizontal partition and the liquid may be loosely filled with cotton or sheep's wool. The addition of either of these will increase the amount of absorption of the carburetting liquid by the gas or air, but these devices are usually unnecessary. The liquid in the lower chamber is allowed to rise till it covers the lower edge of the spiral, or zig-zag, or serpentine vertical partition to the depth of about one-third of an inch, and is always maintained at this height by the following device:—The upper chamber having being made air-tight, a tube runs from within about one-quarter of an inch of the top through the horizontal diaphragm (to which it is firmly soldered) to the bottom of the lower edge of the vertical diaphragm. This tube is for the admission of air to the upper chamber. A second short tube is then soldered into the horizontal diaphragm, and runs to the lower edge of the vertical diaphragm. This tube is for the passage of the liquid from the upper to the lower chamber. When the liquid has risen in the lower chamber to the regulated height no more liquid will pass, as both tubes will be sealed by the liquid. To prevent the liquid from rushing into the lower chamber when the screw nozzle at the top of the upper chamber is taken off for the purpose of refilling the carburettor, the following device is adopted:—At the top of the short tube previously described is a conical plug having the apex turned upwards and prolonged for about one inch, where there is a shoulder; it then passes through a slit or slot in a curved spring, and is attached by a pin to a rod which passes up to the centre of the aperture of the filling nozzle. When the nozzle is unscrewed the rod rises through the aperture through the action of the spring, by which means the conical plug also rises, and shuts off all communication between the upper and lower chambers. In order to indicate the quantity of liquid in the upper chamber, a float with a long rod is adapted thereto. The float-rod is graduated so that when the nozzle above is unscrewed the ball will float and force the graduated rod or tube through the opening, and indicate the height of the liquid in the upper chamber. At the bottom of the lower chamber is a draw-off plug for emptying the lower chamber. If at any time it should be wished to use the gas without carburetting, the filling-nozzle may be unscrewed so as to prevent the liquid from passing through to the lower chamber; the lower chamber may then be emptied. The pipe for supplying the gas or air to the lower chamber, and also the one for taking it away, may either pass through the upper chamber or outside of it. In the latter case the inlet and outlet tubes will perforate the sides of the carburettor immediately below the horizontal diaphragm. By the device for preventing the liquid from rushing into the lower chamber whilst filling, the amount of supply to the lower chamber is regulated, for in proportion as the nozzle is screwed down so will the conical plug descend, thus giving the utmost control over the amount of liquid to be passed into the lower chamber for absorption by the gas.

1316.—JULIUS FRÖLICH, of 2, Park Villas, Lonsdale Road, Barnes, Surrey, for "*Improvements in apparatus for generating gas to be used in gas-furnaces.*" Patent dated April 28, 1869.

This invention has for its object improvements in apparatus for generating gas to be used in gas-furnaces, ensuring a complete utilization of all combustible matter contained in the fuel, and producing a constant and pure gas-flame of high temperature.

The apparatus consists of two fire-brick chambers connected at the bottom by a short flue. The first chamber contains the fuel in a powdered state, such as small coal, coal dust, sawdust, or peat, and is fed from time to time at the top. The fuel descends by gravity, and is burnt by the aid of a fan-blast entering through a number of tuyeres near the bottom of the chamber. The gaseous products of this combustion pass through the flue into the second chamber, which is supplied from time to time by a door placed at or near the top with coke or large pieces of non-bituminous coal, so that all the gases resulting from the combustion in the first chamber are forced to ascend through a column of red-hot coke. The gas is thus converted into carbonic oxide, and is then ready for use, and the carbonic oxide gas thus produced may be burnt by either hot or cold blast as the process to be carried out requires a higher or lower degree of heat. For this purpose the gases are led into the furnace in which they are required to be used, which may be a reverberatory furnace, or a steam-boiler furnace, or other furnace, and air, either heated or cold, is admitted in suitable quantity to burn the carbonic oxide into carbonic acid gas. The same blowing apparatus which forces air into the fuel-chambers may be employed to supply air to the furnace in which the gas is burnt.

1374.—WILLIAM EDWARD NEWTON, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in engines to be used as motors or as pumps for raising or forcing liquid or aëriform bodies.*" A communication. Patent dated May 4, 1869.

This invention relates to a new kind of engine, the principal element of which is a hollow screw or helix, having its axis placed in an inclined position, and arranged to rotate in suitable bearings. When used as a motor the spiral passage of the screw or helix is to such extent supplied or filled with water, or other liquid, that the lower portion of each turn of the helix contains the water or other liquid to such a depth as to form in the upper portion thereof a chamber for steam or vapour. The steam or vapour in the chamber thus formed in the several turns of the screw or helix acts in such a manner both by its direct pressure and expansive force upon the spiral surfaces of the screw or helix as to produce its rotary motion about its axis, and as this rotation is produced the steam or vapour and the water or liquid pass upward through the spiral passage of the screw or helix, at the top of which the steam or vapour escapes to the atmosphere or to a condenser, while the water or liquid enters a central passage formed through the screw or helix, and descends to the bottom thereof.

1375.—ALEXANDER CÆSAR FREDERICK FRANKLIN, of Abingdon Street, Westminster, engineer, and ERNEST DUBOIS, of Primrose Street, Bishopsgate, in the co. of Middlesex, engineer, for "*Improvements in gas-engines.*" Provisional protection only obtained. Dated May 4, 1869.

This invention relates to engines whose power is derived from ordinary coal gas or other gas admitted and exploded within a cylinder wherein is fitted a reciprocating piston, which is connected to a crank fixed on a rotating shaft. The invention consists in using the gas on one side only of the piston, or at one end of the cylinder, the other end of the cylinder being left open, so that the piston is driven in one direction by the force of the gas, and in the other direction by the atmospheric pressure consequent upon a partial vacuum produced by the sudden escape of the gas under pressure from the cylinder at the end of the stroke. By this means a saving of about one-half of the gas hitherto used in such engines for a given power will be effected.

It is necessary that the piston should be made air and gas tight in the cylinder, and the same may be either provided with metallic or other suitable packing, or may be formed of corrugated plates, which, when under pressure on either side of the piston, will expand and fit the cylinder perfectly. The improved gas-engine may be constructed with one cylinder and crank, and the crank-shaft provided with a fly-wheel, or two or more cylinders and cranks may be used, and any known or convenient method of exploding the gas within

the cylinder. If desired, it may be provided with a condensing apparatus, to render the vacuum more perfect.

1382.—ALEXANDER COCKE, of 16, Water Lane, in the City of London, for "*Improvements in apparatus for ventilating railway and other carriages, which improvements are also applicable to ventilating apartments and other places, and to creating draught in chimneys.*" Patent dated May 5, 1869.

This invention consists in forming gratings or other passages, by preference around the roof lamps, for the escape of air from the compartment, and surrounding such passages with a shield, over which is applied a cowl capable of turning on a centre, so that the outlet thereof may be contrary to the direction of motion of the carriage or of the wind, but this cowl, in place of fitting near the lower edge thereof to the shield, is opened out at the part thereof opposite to the outlet therefrom, in order that air may freely flow through the cowl. The lower part of this cowl overhangs the shield to an extent sufficient to prevent rain passing in that direction.

1401.—ERNEST SEYD, of Princes Street, in the City of London, for "*Improvements in fluid-meters.*" A communication. Patent dated May 7, 1869.

The nature of this improvement consists in making a piston fluid-meter as follows:—First, of such a form as to have great strength and durability combined with cheap construction and little weight; secondly, to float the moving valve-pistons with cork or its equivalent, and to leave them disconnected and free to move independent of each other, so that they will obey the slightest impulse of the water, and thereby bring friction resistance, and therefore the reduction of head, to a minimum; thirdly, so as to avoid the carrying of dead water, which seriously obstructs free motion; fourthly, to let the water in upon the valve-pistons or their equivalents in such a manner as to have them perfectly balanced under any pressure, and thereby also to prevent reduction of head; fifthly, so as to avoid the bursting of the meter through the "ram action" of water suddenly checked, and in case the water therein should freeze; sixthly, with a registering arrangement by which the distance travelled over by the pistons is recorded, and by which small fractions of the liquid can be measured as well as large quantities recorded with only two index fingers; and such other minor advantages and improvements as are herein minutely set forth.

1405.—JOHN RAMSBOTTOM, of Leeds, in the co. of York, hydraulic engineer, and THOMAS MASSEY PEARCE, of Bradford, in the co. aforesaid, wool merchant, for "*Improvements in steam and hydraulic apparatus for pumping, forcing, and measuring water, and for raising weights.*" Patent dated May 7, 1869.

In carrying out this invention there is cast on the cylinder end of a steam or water pressure pumping-engine, and forming a part of its end cover, a small valve-cylinder at right angles to the cylinder proper, and in this valve-cylinder is placed a piston-valve intended to be moved longitudinally in either direction by the steam or water with which the engine is worked.

1429.—JOHN WITHERS, of Handsworth, in the co. of Stafford, for "*Improvements in water-meters.*" Patent dated May 10, 1869.

This invention relates to a peculiar construction, arrangement, and combination of apparatus for measuring liquids, and for registering the quantity measured, and consists in combining one or more horizontal cylinders of any known capacity, provided with pistons and rods working through stuffing-boxes with self-acting inlet and outlet valves and self-acting slide-valve, for directing the flow of the water to each end of the measuring cylinder or cylinders alternately. According to one arrangement there is fixed to the outer ends of the measuring-cylinders a cylindrical valve-case, having two lateral openings communicating through the end of the measuring-cylinder with the interior thereof. In each of these valve-cases work two piston-valves so disposed that when one of the openings, say the inlet, is open to the cylinder the other or outlet shall be closed, and *vice versâ*. The spindles of these piston-valves may be connected together by an oscillating beam or lever, which causes one pair of piston-valves to descend when the other is ascending, the pressure of the water in the inlet-pipe leading to the cylindrical valve-cases alone serving to work the valves. In order to direct the flow of water into the opposite ends of the measuring cylinder or cylinders alternately, suitable valves are employed to the inlet pipe or pipes, which valves are worked by the aid of a weighted lever acted upon by a moveable or fixed arm or projection at each stroke, so as to cause the weighted lever by its impulse to change suddenly the position of the slide or other valve or valves. The counting or registering mechanism may be worked by a pinion gearing into rack teeth formed on the measuring piston-rod, or by any other suitable mechanical contrivance for transmitting motion from such rod. The whole is enclosed in a suitable framework or casing.

1442.—BALDWIN LATHAM, of 6, Westminster Chambers, Westminster, in the co. of Middlesex, civil engineer, for "*Improvements in ventilators for sewers, also applicable for deodorizing noxious gases arising in the processes of certain manufactures.*" Patent dated May 11, 1869.

This invention consists in so arranging spirally or otherwise arranged channels or passages inside the ventilating-chamber, containing charcoal or other deodorizing material, that, while any water that enters the ventilator can pass freely through such channels or passages down into the sewer without coming in contact with the deodorizing material, yet any noxious gases passing up through such channels will be brought into contact with the deodorizing material before issuing from the ventilator.

1457.—JOHN LOWE GREATOREX, of East Grinstead, in the co. of Sussex, plumber, for "*Improvements in urinals.*" Patent dated May 12, 1869.

This invention consists in so constructing the slab and overflow that they form their own trap, and stand permanently half filled with water. They are thus enabled to effect the irrigation of the whole of the interior parts of the basin and back by means of perforations or openings in the hollow moulding and rim of the basin. At the soffit of the top moulding is provided a guide to prevent any spray of water from the perforation at the soffit.

1477.—ISAAC STOREY and JOHN HENRY STOREY, both of Manchester, in the co. of Lancaster, brassfounders, and HENRY LEA, mechanical engineer, and THOMAS LANE, civil engineer, both of Birmingham, in the co. of Warwick, for "*Improvements in means for controlling the discharge of water from stand-pipes, drinking fountains, and ball taps or valves*" Patent dated May 14, 1869.

In carrying out this invention a valve is employed on the stand-pipe or fountain, the inlet orifice of which is closed by a diaphragm, acted upon by the pressure of the water when admitted to the back of the diaphragm. The space at the back of the said diaphragm is in communication with a small valve, which, when opened, relieves the back of the diaphragm from the said pressure, and thus permits the discharge of water from the main-valve.

1493.—LOUIS ANTOINE VICTOR DUBOURG, of Leicester Street, Leicester Square, in the co. of Middlesex, doctor of medicine, for "*Improvements in the manufacture of gas for lighting and heating purposes, and in the apparatus employed therein.*" Patent dated May 15, 1869.

This invention consists in an improved process and apparatus for the economical production of a brilliant gas from hydrogen (obtained by the decomposition of water) with the addition of liquid hydrocarbons. The apparatus employed for the purpose is of a very simple character, occupies but small space, acts automatically, and requires but very little attention.

The apparatus consists of two parts, comprising—first, the gas generator, with a purifier attached thereto; and, second, the carburetter, for imparting to the hydrogen gas the requisite amount of carbon to convert it into an illuminating gas. In the generator the process is carried on automatically, and the gas is produced by the decomposition of water by means of the chemical action of acidulated water on metals. The gas arrives in the carburetter in a nascent state, and by being made to bubble up through the liquid hydrocarbon contained therein, takes up the carbon vapour which gives it its illuminating power. The generator is a vessel divided into an upper and lower compartment; the upper one of which contains acidulated water, and the lower one metallic zinc or iron. These compartments are made to communicate together by means of a pipe, provided with a cock for the purpose of supplying the water in suitable quantities to the lower compartment. The lower compartment is provided with a perforated false bottom, on which the metallic zinc is placed. A small vessel containing sulphuric or hydrochloric acid is placed above the generator, and is provided with a cock so that a uniform quantity of acid may be supplied to the water compartment. A constant but regulated quantity of the acidulated water is allowed to run into the lower part of the zinc compartment, and by acting on the metal the water will be decomposed, and will evolve hydrogen gas, which will fill the compartment, and pass off through a pipe either direct to the carburetter or to a purifier, and from thence to the carburetter, which it will enter under considerable pressure.

The carburetter is a vessel which is divided into two parts, consisting of separate compartments for holding the liquid hydrocarbon. The upper one of these forms the reservoir, which communicates by a tube with a well in the lower compartment below. In practice it is found advantageous to divide the lower compartment into two chambers or wells, both of which are kept supplied from the upper compartment by suitable tubes with the liquid hydrocarbon, into which the hydrogen gas bubbles from a rose-head at the end of the pipe. In bubbling up through the liquid in the first well or division of the lower compartment the gas takes up a portion of carbon, and passes off to a second well, which is also supplied with hydrocarbon liquid from the compartment above. By this means the gas becomes thoroughly carburetted, and ultimately passes off to the burners.

1501.—HENRY DE GARRS, of 2, Summerfield Street, Eccleshall Road, in the township of Eccleshall Bierlow, Sheffield, in the co. of York, brass and wood turner, for "*Improvements in gas-pendants and chandeliers.*" Provisional protection only obtained. Dated May 17, 1869.

These improvements consist in the insertion in the inside of the gas-pendants and chandeliers of an elastic or spring tube for conveying the gas to the burner, so that the gas-pipe retains an unbroken connexion, whether the pendant be slid up or down.

1517.—JAMES NORTON, of Sheffield, in the co. of York, lead and glass merchant, for "*Improvements in ball and other cocks, taps, and valves.*" Provisional protection only obtained. Dated May 18, 1869.

A ball-cock constructed according to this invention has a chamber in the centre of the cylinder, through which works a cone-valve attached to the lever of the ball, which by direct action opens or shuts the valve and prevents its sticking.

1522.—JOHN WOODWARD, of Queen's Foundry, New Islington, Ancoats, in the city of Manchester, in the county of Lancaster, engineer, for "*Improvements in gas and water meters.*" Provisional protection only obtained. Dated May 18, 1869.

This invention consists in the combination of an india-rubber or other elastic or flexible diaphragm, with concave or recessed plates or castings having ports and passages in them for the gas or liquid to communicate with each side of the diaphragm, and a slide or other valve or valves to open and shut the communication alternately with the supply and outlet pipe, such valve or valves being actuated by the said diaphragm, which gives movement to a rod that works a weighted "tumbler" lever connected with or acting upon the valve through a lever or tappet upon an oscillating shaft. The diaphragm beds against the concave surface of the plates or casting each time a compartment is filled. Thus a constant and uniform measure is secured, and undue strain upon the diaphragm is prevented. The index or counting apparatus is connected with the oscillating lever-shaft above named. The diaphragm is secured between the flanges of the concave plates or castings, and it also forms the packing to make the joint between them. Two or more diaphragms, with sets of concave plates, may be combined together to form one meter according to my invention, and two diaphragms may be combined so that one will work the valve for the other alternately.

1557.—ZEBULON ERASTUS COFFIN, of Newton Centre, in the State of Massachusetts, U.S.A., for "*Improvements in stop-cocks or valves.*" Patent dated May 29, 1869.

In carrying out this invention the case of the cock is connected to the pipe or pipes by couplings, bolts, or otherwise, and the case contains two flat valve-seats facing each other, and standing at an inclination to each other. Between these seats the valves work, and they are slid off the seats to open the cock, or forced down between the inclined seats to close the same.

APPLICATIONS FOR LETTERS PATENT.

1295.—ABRAHAM RIPLEY, of 34, West Square, St. George's Road, Southwark, in the co. of Surrey, engineer, for "*A new or improved pipe-wrench.*" May 6, 1870.

1300.—EDWARD THOMAS KIRKPATRICK, of Brussels, in the kingdom of Belgium, doctor of natural science, for "*A new or improved mode of producing oxygen gas at the ordinary temperature of the air, or at a higher temperature.*" May 6, 1870.

1314.—ASHLEY PASTON PRICE, of 47, Lincoln's Inn Fields, in the co. of Middlesex, consulting chemist, for "*Improvements in the treatment of sewage, and in the production of manures.*" May 7, 1870.

1340.—HECTOR AUGUSTE DUFRENÉ, of 10, Rue de la Fidélité, Paris, and 4, South Street, Finsbury, London, civil engineer and patent agent, for "*An improved water-meter, parts of which are applicable for other purposes.*" A communication. May 11, 1870.

1342.—JULES CROUZIERES, of Museum Street, Bloomsbury, in the co. of Middlesex, engineer, for "*An improved gas and water-tight joint to pipes and tubes.*" May 11, 1870.

1352.—EDWARD PRIMROSE HOWARD VAUGHAN, of 54, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in the construction of and methods of working gas-engines.*" A communication. May 11, 1870.

1354.—GEORGE WILLIAM WIGNER, of 1, St. Swithin's Lane, in the City of London, analytical chemist, for "*Improvements in deodorizing and purifying sewage, and in making manure therefrom.*" May 12, 1870.

1329.—BERNARD HIPPOLYTE CHAMEROY, of the city of Brussels, in the kingdom of Belgium, mechanician, for "*Improvements in cocks.*" May 10, 1870.

1335.—WILLIAM ROBERT LAKE, of Southampton Buildings, London, consulting engineer, for "*Improvements in apparatus or machinery for making gas from liquid hydrocarbons for illuminating purposes.*" A communication. May 10, 1870.

1382.—HENRY ORMSON, of Stanley Bridge, Chelsea, in the co. of Middlesex, horticultural builder and hot-water apparatus manufacturer, for "*Improvements in warming and ventilating horticultural buildings and other structures.*" May 14, 1870.

1403.—JAMES YATES, of Birmingham, in the co. of Warwick, manufacturer, for "*Improvements in taps or stop-cocks.*" May 16, 1870.

1410.—CHARLES HUNT, of Nine Elms, in the co. of Surrey, engineer, for "*Improvements in retorts and retort-settings.*" May 17, 1870.

1449.—Robert Pitt, of the firm of Stothert and Pitt, of Newark Foundry, Bath, in the co. of Somerset, engineers, for "*Improvements in valves for drawing off water and other fluids, applicable to water-cranes, and for other uses.*" May 19, 1870.

1455.—Joseph Breeden, of the firm of J. and W. Breeden and Booth, of Birmingham, in the co. of Warwick, manufacturers, for "*Improvements in lift and force pumps.*" May 19, 1870.

1456.—Alexander Melville Clark, of 53, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in apparatus for the production of gases for lighting and heating purposes.*" A communication. May 19, 1870.

GRANTS OF PROVISIONAL PROTECTION.

1184.—John Pardoe Ferris and Edward Craddock, both of 17, Gresham Street, in the City of London, civil engineers, for "*An improved portable apparatus for generating illuminating gas.*" April 23, 1870.

1240.—Victor Barlon, of 40, Rue du Roi de Sicile, in the city of Paris, in the French empire, for "*An improved apparatus for regulating the pressure of gas in gas-burners.*" April 30, 1870.

1262.—James Anthony Emslie, of Tarbert, in the co. of Argyll, gentleman, and James Thomas Emslie, of North Shields, in the co. of Northumberland, engineer, for "*Improvements in apparatus for lifting, forcing, or conducting liquids, gases, or air.*" May 3, 1870.

1274.—William Woodward and Adam Woodward, jun., of the city of Manchester, in the co. of Lancaster, engineers, for "*Improvements in apparatus or arrangements to be used in connexion with retorts for the manufacture of gas.*" May 4, 1870.

1285.—Joseph Bryan Hickmott, of Carlisle, in the co. of Cumberland, engineer, for "*Improvements in the manufacture of gas and coke, and in the apparatus to be employed in the same manufacture.*" May 5, 1870.

1295.—Abraham Ripley, of 34, West Square, St. George's Road, Southwark, in the co. of Surrey, engineer, for "*A new or improved pipe-wrench.*" May 6, 1870.

1300.—Edward Thomas Kirkpatrick, of Brussels, in the kingdom of Belgium, doctor of natural science, for "*A new or improved mode of producing oxygen gas at the ordinary temperature of the air, or at a higher temperature.*" May 6, 1870.

1311.—Robert Weare, of Newcastle-under-Lyme, in the co. of Stafford, sanitary contractor, for "*Improvements in apparatus for receiving and treating sewage and other noxious matters.*" May 7, 1870.

1314.—Astley Paston Price, of 47, Lincoln's Inn Fields, in the co. of Middlesex, consulting chemist, for "*Improvements in the treatment of sewage, and in the production of manures.*" May 7, 1870.

1329.—Bernard Hippolyte Chameroy, of the city of Brussels, in the kingdom of Belgium, mechanician, for "*Improvements in cocks.*" May 10, 1870.

1335.—William Robert Lake, of Southampton Buildings, London, consulting engineer, for "*Improvements in apparatus or machinery for making gas from liquid hydrocarbons for illuminating purposes.*" A communication. May 10, 1870.

1340.—Hector Auguste Dufrené, of 10, Rue de la Fidélité, Paris, and 4, South Street, Finsbury, London, civil engineer and patent agent, for "*An improved water-meter, parts of which are applicable for other purposes.*" A communication. May 11, 1870.

1342.—Jules Crouzieres, of Museum Street, Bloomsbury, in the co. of Middlesex, engineer, for "*An improved gas and water tight joint to pipes and tubes.*" May 11, 1870.

1352.—Edward Primerose Howard Vaughan, of 54, Chancery Lane, in the co. of Middlesex, patent agent, for "*Improvements in the construction of and methods of working gas-engines.*" A communication. May 11, 1870.

1354.—George William Wigner, of 1, St. Swithin's Lane, in the City of London, analytical chemist, for "*Improvements in deodorizing and purifying sewage, and in making manure therefrom.*" May 12, 1870.

NOTICES TO PROCEED.

3.—Stephen Holman, of 10, Laurence Pountney Lane, in the City of London, engineer, for "*Improvements in apparatus for hinging, adjusting, and fastening gas-retort lids, covers, or doors, and other lids, covers, and doors.*" Jan. 1, 1870.

35.—Isham Baggs, of High Holborn, in the co. of Middlesex, practical chemist, for "*Improvements in purifying coal gas.*" Jan. 5, 1870.

38.—Edmund Edwards, of 22, Buckingham Street, Adelphi, in the co. of Middlesex, for "*Improvements in cocks and valves.*" Jan. 5, 1870.

61.—John Carnaby, of 252, High Holborn, in the co. of Middlesex, gas apparatus manufacturer, for "*Improvements in dials for gas-regulators, and in dials in general; also in bezils or rings for dial-faces.*" Jan. 7, 1870.

80.—Edme Augustin Chameroy, of 23, Boulevard de Strasbourg, Paris, for "*Improvements in means and apparatus for gauging or regulating the flow of water or other liquids.*" Jan. 11, 1870.

113.—George Thornelor, of 34, London Wall, in the City of London, gas engineer, for "*A new flexible valve, for regulating the flow of fluids in pipes, also used in apparatus for the manufacture of gas.*" Jan. 13, 1870.

481.—Richard Hunt, of Scarborough, in the co. of York, hotel-keeper, for "*An improved apparatus or receptacle for storing and for withdrawing wine or other liquids, part of which apparatus is also applicable wherever a tap may be required.*" Feb. 18, 1870.

1197.—George Jordan Firmin, of 19, Lorn Road, North Brixton, in the co. of Surrey, for "*Improvements in self-registering water or liquid gauges.*" April 25, 1870.

1206.—John Palmer, of the firm of Palmer Brothers, 10, Royal Promenade, Queen's Road, Bristol, ironmongers, for "*Improvements in gas cooking-stoves.*" April 26, 1870.

1227.—Charles William Alden, of Charlestown, in the state of Massachusetts, U.S.A., for "*Certain new and useful improvements in pipe-wrenches.*" A communication. April 23, 1870.

1252.—William Robert Lake, of Southampton Buildings, London, consulting engineer, for "*An improved valve or stop-cock.*" A communication. May 2, 1870.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1300.—John Ramsbottom and Thomas Massey Pearce, "*Improvements in the construction of turbines and other hydraulic engines or apparatus for obtaining motive power, and for measuring the flow of fluids.*" May 3, 1867.

1303.—Charles Bosch Reitz, "*Improvements in meters for measuring the flow of water and other fluids, which improvements are applicable also in the construction of pumps for air, water, and other fluids.*" May 3, 1867.

1407.—William Robert Lake, "*An improved mode of constructing metal cocks, faucets, and other similar articles.*" May 11, 1867.

PATENT WHICH HAS BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

1118.—Edwin Chesshire, "*Improvements in apparatus for intercepting the solid portions of the soil of water-closets.*" May 5, 1863.

Advertisements.

FLETCHER, SPECK, & CO.,

CONTRACTING GAS ENGINEERS, IRON & BRASS FOUNDERS,

GLENGALL IRON-WORKS, MILLWALL, LONDON, E., and **RATCLIFF FOUNDRY, COMMERCIAL ROAD EAST, LONDON, E.,**

Manufacturers of **Gasholders, Tanks, Purifiers,** and every description of **Gas-making Apparatus.** Iron Main-pipes supplied and laid. Retorts, Mouthpieces, Retort-lids, Valves, and Fittings. Wrought and Cast Iron Hydraulic Mains. Improved **Wrought-Iron Column Stills,** for working **Ammoniacal Liquor. Chemical Plant** for **Gas-Works** erected complete, on the most approved system. Lamp-posts, Columns, Girders, Bridges, &c.

CORRUGATED IRON ROOFS & BUILDINGS.

GENERAL GAS CASTINGS PROMPTLY EXECUTED.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

IMPROVED WET & DRY CONSUMERS GAS-METERS,

GAS STATION-METERS,

With all the Joints planed,

GOVERNORS, GAUGES, INDICATORS, EXHAUST GOVERNORS, &c.

TERMS, &c., ON APPLICATION.

Price Current.

CASTINGS.—*Per Ton.*

Average Weight of Cast-iron Gas-pipes, per Yard.

1 in.	2 in.	2½ in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	12 in.
16	21	28	33	51	70	89	107	126	149	177	208 lb.

Retail Prices are 5 to 10 per cent. higher.	London.	Glasgow.	Newcastle and Middlesboro'.	Wales.	Yorkshire, Derbyshire, and Staffordshire.
	£. s. d.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Pig Iron, No. 1 (g.m.b.)	3 17 6	3 17 6	3 14 0	3 10 0	3 15 0
1¼ and 2-inch Socket-pipes	7 0 0	5 15 0	5 10 0	6 0 0	7 0 0
2½ and 3-inch ditto	6 10 0	5 5 0	5 0 0	5 15 0	6 10 0
4 and 5-inch ditto	6 0 0	4 15 0	4 10 0	5 5 0	6 0 0
6 inches and upwards ditto	5 15 0	4 5 0	4 0 0	5 0 0	5 15 0
Retorts, 1st fusion, hot blast	5 10 0	4 10 0	4 5 0	5 0 0	5 10 0
Ditto, 2nd ditto, cold ditto	6 10 0	—	—	—	6 10 0
Tank-plates, ¼ thick and above	6 0 0	5 0 0	4 15 0	5 10 0	6 0 0

WROUGHT-IRON TUBING,

Subject to 60 per cent. Discount.

	2 in.	1½ in.	1¼ in.	1 in.	¾ in.	½ in.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Patent Welded Tubes, from 2 to 14 feet—per foot	1 8	1 1	0 10	0 7	0 5	0 4½
Ditto ditto, from 12 in. to 23½ in.—each	3 0	2 0	1 6	1 1	0 9	0 8
Long Screws, from 13 in. upwards	4 0	2 3	2 0	1 6	1 2	0 11
Bends and Springs	4 3	2 3	1 9	1 3	0 11	0 8
Square Elbows, equal or reducing; Round Elbows, 5 per cent. extra	3 9	2 3	1 9	1 3	0 10	0 8
Tees, wrought or cast	4 0	2 6	2 0	1 6	1 1	0 9
Crosses, ditto, equal or reducing	4 9	3 6	3 0	2 3	1 9	1 6
Iron Cocks	20 9	13 0	10 0	7 3	5 0	3 8
Ditto, with brass plug	28 0	16 0	13 0	7 0	5 6	4 6
Diminishing Sockets, Caps, Plugs, and Nipples	1 3	0 9	0 8	0 6	0 5	0 4½
Plain Sockets	1 0	0 8	0 7	0 5	0 4	0 3
Syphons, 2-quart	15 0	14 0	13 6	13 0	12 0	—

GAS COALS.

Newcastle—Unscreened:—	Per Ton. 6s. 6d.
Haswells, Nettlesworth Primrose, and South Pelaw	
Felling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7 0
Peareth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	15 0
Wigan Cannel (at Liverpool)	17 0
Welsh Cannel:—	
Coppa Cannel (on rails at Birkenhead), 13s. 6d.; ditto (on rails at Connah's Quay)	13 0

Scotch Cannel, f.o.b.:—	Per Ton.	*Scotch Cannel*, f.o.b.:—	Per Ton.
Boghead—at Bo'ness, 47s. 6d.; at Leith	48s. 2d	Arniston (at Leith)	21s. 0d
Muirkirk	27 0	Wemyss (at Wemyss)	20 0
Kirkness, best (at Burntisland)	22 6	Haywood and Co.'s Haywood (at Granton)	20 0
Capeldrae, 1st quality (at ditto)	22 6	Pirnie, or Methill	17 0
Ditto, 2nd ditto (at ditto)	17 6	Lothian's Cannel (at Leith)	21 3
Cowdenbeath (at ditto)	12 0	Grange ditto (at Bridgeness)	17 6
Lochgelly (at ditto)	13 0	Kinnail ditto (at Bo'ness)	17 6
Donnibristle—at Burntisland, 12s.; at Aberdour	12 6	Myles' ditto	23 6
Auchinheath Lesmahago (at Granton)	27 0	Lochore Parrot (at Burntisland)	22 6
Nitshill and Lesmahago Coal Company (at Granton)	26 6	Lanemark (at Glasgow)	16 0
		Elphinstone Tower (at Leith)	20 0

FREIGHTS.

Coastwise—Newcastle:—	Per Ton.	*Foreign:*—	Per Keel.
Chatham and Rochester	5s. 9d. to 6s. 3d	Barcelona	£19 0s
Cork	9 6	Bordeaux	12 0
Dover, Folkestone, and Ramsgate	6 9	Boulogne and Calais	8 0
Dublin	10 0	Cadiz	11 10
Exeter Quay	9 6	Cronstadt	12 0
Ipswich	5 0	Copenhagen	8 10
London (from Leith)	8 6	Genoa	17 0
London (Pool)	5 9	Hamburg	8 10
Lowestoft and Yarmouth	4 6	Havre de Grace	10 0
Portsmouth & Southampton	6s. 6d. to 7 0	Leghorn	17 0
Plymouth	8 6	Lisbon	12 0
Shoreham	7 0	Rotterdam	8 0
Whitstable	6s. 9d. to 7 0	Stettin	9 15
Weymouth	8 0	Trieste	17 0
		Venice	18 10

SUNDRIES.

Best Newcastle Fire-bricks, per 1000	£2 10s. to £2 15s. 0d.
Cliff's Fire-bricks (at Wortley), per 1000	2 13 6
Ingham's ditto (at Wortley), per 1400	2 15 0
Farnley Iron Co.'s Fire-bricks (at Wortley), less discount	2 17 9
Fire-clay Retorts, per foot run	5s. 6d. to 0 7 6
Tarred Rope Yarn, per cwt.	1 0 0

CHEMICAL, MINERAL, AND METAL MARKETS.

[From J. Rebder Spence and Co.'s Weekly Report.]

Soda.—Cream Caustic Soda is in good request at £12 10s. for 60 per cent.; and White, at £13 to £13 10s. Soda Ash, as before, at 1 11-16d. to 1¾d. Crystals active, at £4 to £4 5s. Bicarbonate, £9 5s., and £15 for Refined. Saltcake, at 58s. Sulphate of Soda, at £3.

Nitrate of Soda has had a downward tendency, closing with a fair demand at £15 5s. to £15 10s.

Potash.—Muriates continue very firm, and a good trade is being done at £8 5s. to £8 10s. for 80 per cent.

Saltpetre.—There has not been much done, yet prices have not given way.

Alum.—Average sales, both for home and foreign requirements. Loose Lump, at £6 5s., and £7 in export barrels; Ground, £7.

Ammonia.—Brown Sulphate is again in good demand, with prices at from £13 to £13 10s. There is a shade better business done in White and Grey, at £15 to £16.

Copperas.—Consumers appear to be pretty fully stocked with Green and Rusty, and therefore prices are somewhat in buyers favour. Dry is active, at 52s.

Arsenic.—There is a good inquiry, and holders are unwilling to sell at less than £7 and £7 5s. for Fine Powdered.

Acid.—Oxalic continues to maintain the advance of 7½d. to 8d. Tartaric is firmer at 1s. 2½d. to 1s. 3d. Sulphuric, at £3 15s. per ton.

Magnesia.—Epsom Salts, at £4 10s., to £4 12s. 6d. for Refined.

Pitch.—There is no alteration to report.

Benzole.—In active request at 2s. 4d. per gallon for 90 per cent.

Disinfectants.—There is an average demand for Patent Disinfectants for sewage and other purposes, at £5 per ton. Carbolic Acid, at 1s. to 1s. 3d. per pound.

Pyrites.—There is a uniformly good demand, at 6½d. to 7½d. per unit. Calcined Spanish, at 43s. 6d. R.C.

Manganese.—At 80s. for 70 per cent., and dull.

Iron Ore.—There has been no check to the demand previously reported. Hematite, 13s.; Oolitic, 8s. 6d. to 8s. 6d. in Staffordshire, and 2s. 9d. free on rails.

Iron.—Scotch Pig steady at 57s. 6d. to 57s. 9d.; Cleveland strong, at 50s. for Forge 4, to 54s. 6d. for No. 1; Welsh Bars, £6 10s. to £7; Staffordshire Bars, £7 10s. to £8 10s.; Hoop Iron, £9; Gas Tubes, 60 per cent. to 67½ per cent. off list; Boiler Tubes, 40 per cent. to 42½ per cent.

Copper.—Improved. English Tough Ingot, £70 to £71. Chili Slab, £66 15s. to £67 5s.

Tin.—Steady. English Ingot, £135 to £136; Straits, £132 to £133.

Lead.—Quiet. Best English Soft Pig, £18 10s.

Spelter.—Unchanged. English, £19 10s. to £20. Silesian, special brands, £19 15s. to £20.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	11½ — 12
1000	20	Do., preference	20 0 0	10 0 0	22 — 23
750	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	4 10 0	5⅜ — 6
10000	5	Do., third issue	4 0 0	4 10 0	4⅜ — 5
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbridge, & Holywell.)	20 0 0	10 0 0	30½ — 31¼
7500	20	Cagliari (Limited)	20 0 0	7 0 0	
12000	50	*Chartered*	50 0 0	8 0 0	63 — 70
6000	50	Do.	45 0 0	8 0 0	64 — 65
30000	10	Do., preference	2 0 0	5 0 0	3 — 3½
10000	20	*City of London*, A shares	20 0 0	9 0 0	24 — 26
10000	10	Do., B shares	10 0 0	4 0 0	6⅞ — 7
9629	10	Do., new shares	10 0 0	9 0 0	12½ — 13
17490	25	*Commercial*	25 0 0	10 0 0	42 — 43
20000	20	Continental Union	20 0 0	8 0 0	28 — 29
10000	10	Do., new	5 0 0	..	8¾ — 9
5213	20	Do., preference	20 0 0	7 0 0	25 — 26
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16 — 16½
5000	10	Do., preference	10 0 0	6 0 0	11 — 11½
10000	10	Do., new shares	10 0 0	7 0 0	12 — 12½
4000	50	*Equitable*	50 0 0	10 0 0	84 — 85
4000	25	Do., new shares	25 0 0	10 0 0	40 — 41
23406	10	European (Limited)	10 0 0	11 0 0	18 — 19
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 0 0	11 0 0	9½ — 10
20000	10	*Great Central Gas Consumers*	10 0 0	..	18 — 19
5000	10	Hong Kong (Limited)	10 0 0	7 0 0	11 — 12
26000	50	*Imperial*	50 0 0	10 0 0	84 — 85
26000	10	Do., new shares	7 0 0	10 0 0	12½ — 13
26000	12½	Do., new shares	12 10 0	7 0 0	14⅝ — 15
1300	100	Do., bonds	£100	10 0 0	175 —180
28000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam., Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	18 5 0	137 —138
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	64 — 65
3000	10	Do.	10 0 0	5 0 0	7 — 9
3000	20	Do.	15 0 0	7 10 0	17 — 18
7133	50	*London*	50 0 0	10 0 0	81 — 83
5610	25	Do., 1st preference	25 0 0	6 0 0	28 — 29
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
		Nictheroy, Brazil (Limited)			
15000	5	Malta and Mediterranean (Limited)	5 0 0	3 10 0	3½ — 4
6000	5	Do., preference	5 0 0	7 0 0	4⅞ — 5¼
30000	5	Oriental (Calcutta)	5 0 0	10 0 0	8½ — 9
30000	5	Do., new shares	1 10 0	10 0 0	3 — 3½
10000	5	Ottoman (Limited)	5 0 0	nil.	2 — 2⅝
14000	10	Pará (Limited)	10 0 0	10 0 0	10 — 11
27000	20	*Phœnix*	20 0 0	10 0 0	33 — 34
3600	100	Do., new	40 0 0	7 10 0	45 — 47
144000	8k.	Do.	100 0 0	5 0 0	83 — 86
5000	20	*Rateliff*	20 0 0	10 0 0	27 — 28
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	28½ — 29
6959	5	Singapore (Limited)	5 0 0	5 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
1500	32½	Shanghai	32 10 0	12 0 0	
4000	50	*South Metropolitan*	50 0 0	10 0 0	82 — 85
4000	12½	Do.	12 10 0	10 0 0	20 — 22
20000	12½	Do., new shares	1 0 0	10 0 0	3 — 3½
15000	10	*Surrey Consumers*	10 0 0	10 0 0	16 — 16½
10000	10	Do., new	6 0 0	10 0 0	9 — 9½
9000	4	United General (Limerick)	4 0 0	5 0 0	2½ — 2⅝
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	10 — 12
1500	10	Do.	10 0 0	7 10 0	
1819	10	Do.	10 0 0	7 10 0	
1138	10	Do.	5 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	17 — 17½
10000	10	Do., B shares	8 0 0	10 0 0	14½ — 15
10000	10	Do., C shares	8 0 0	10 0 0	13 — 13½
20000	10	Do., D shares	1 0 0	10 0 0	2½ — 3
16000	5	*West Ham*	5 0 0	7 10 0	7 — 7½
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

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Where all communications are requested to be addressed.

WANTED, a situation as Manager of Gas-Works, or FOREMAN of a work. Thoroughly understands the manufacture of gas, main-laying, meter inspecting, and fitting work generally. The make of gas at the works he now has the charge of is about 30,000,000 cubic feet per annum. Satisfactory reasons for leaving present situation.
Address H. J., Gas-Works, UXBRIDGE.

WANTED, by the Advertiser, a situation as METER INSPECTOR or GAS-FITTER, or can take the management of a small work. Aged 27. Has had a thorough practical knowledge of gas and every branch of the trade, and has had similar situations before. Good references.
Address A. C. H., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young Man, aged 23, who thoroughly understands the manufacture of coal gas, and has been nine years in a Gas-Work, a situation as CLERK or ASSISTANT MANAGER. Can use the photometer. Highest testimonials. No objection to go abroad.
Address GAS, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Man 43 years of age, a situation as MANAGER of a Gas-Work where one or more stokers are kept. Understands setting retorts, laying mains, and the whole duties as Manager. Has been seven years in present situation. Good testimonials.
Address C. T., Post-Office, Ketton, Stamford, RUTLAND.

WANTED, a Gas Engineer of experience fully competent to take charge of the Hull Works of the British Gaslight Company, Limited. Salary to commence at £300, with residence on the works.
Applications, by letter only, endorsed "Gas Engineer," stating age and qualifications, and enclosing copies of testimonials, to be addressed to the SECRETARY of the Company, No. 11, George Yard, Lombard Street, LONDON, E.C., on or before the 31st inst.

WANTED, by a young Man, aged 18, RE-EMPLOYMENT on a Gas-Work. Understands main-laying, fitting, and all operations connected with the manufacture of gas. Good character.
Address D. JONES, Post-Office, New Barnet, HERTS.

WANTED, a steady Man, as Working FOREMAN of a small Gas-Work. Competent to take the indices of meters, lay mains and services, and do the general retort-fittings in the Gas-Works. Wages 25s. per week, with cottage, coals, and gas free.
Applications, stating age, to be sent to P. SIMPSON, Gas-Works, RUGBY, on or before Thursday, June 2, 1870.

GAS-FITTER WANTED.

WANTED, by the Weymouth Consumers Gas Company, a GAS-FITTER and SERVICE-LAYER. Must be thoroughly competent to read the indices of meters. Wages 25s. per week.
None need apply whose character will not bear the strictest investigation both for ability and integrity.
Address Mr. THOMAS STONE, Manager.

BOROUGH OF SOUTHPORT.

WANTED, by the Corporation of Southport, a thoroughly competent MANAGER for the Gas-Works. Ability to draw plans and give specifications for future extension of works is desirable. Applicant should also possess a knowledge of the manufacture of naphtha and sulphate of ammonia. Salary £140 a year, with house, coals, gas, and rates.
Apply by letter, with testimonials, stating age, number of family, &c., addressed to the Chairman of the Gas Committee, Town-Hall, Southport, on or before the 4th of June, 1870.
By order,
KEIGHLEY WALTON, Town-Clerk.

TO GAS COMPANIES, ENGINEERS, &c.

AN experienced Gas-Fitter is in want of a SITUATION. Good testimonials, &c.
Address J. B., 9, Brunswick Place, Brook Street, Upper Clapton, LONDON, N.E.

WANTED, first-class Wet and Dry Gas- METER MAKERS.
Apply at the Imperial Meter Company's Works, King's Road, LONDON, N.W.
May 23, 1870.

WANTED, by a thoroughly competent young Man, a situation, either as Assistant Manager and Secretary, Chief Clerk, Rental Clerk, or Collector, at a Gas-Work. Six years as above in present situation.
Address W. T., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COAL TAR.

TO BE LET, for One, Two, or Three years, the TAR produced at the Works of the Sunderland Gas Company, from the 1st day of July next. Quantity about 250,000 gallons per annum.
The principal manufacturing station of the Company has a siding on to the North-Eastern Railway, and is close to the South Dock.
The Directors will receive tenders until Tuesday, the 14th day of June.
Sunderland, May, 1870. J. H. COX, Secretary.

TO BE SOLD CHEAP, at the Works of the Crystal Palace District Gas Company, several 12-in., 10-in., and 8-in. External and Internal BACK-VALVES, equal to new, having been put in thorough repair. Also some 12-in. and 10-in. Tees, Bends, and other connecting-pipes, and two of Beales's Exhauster By-passes.
To be seen on application to the Engineer and Manager, Mr. E. S. Cathels.—By order of the Board,
MAGNUS OHREN, Secretary.
Offices at the Works, Lower Sydenham, S.E.,
May 20, 1870.

BRITISH ASSOCIATION OF GAS MANAGERS.

THE SEVENTH ANNUAL GENERAL MEETING OF MEMBERS

WILL BE HELD ON TUESDAY, MAY 31,
AND
TUESDAY, WEDNESDAY, AND THURSDAY, the 7th, 8th, and 9th of June, 1870,
AT THE ROOMS OF THE
SOCIETY OF ARTS, JOHN STREET, ADELPHI, LONDON.

MAGNUS OHREN, ESQ., A.I.C.E., VICE-PRESIDENT, *Will occupy the Chair.*

ORDER OF PROCEEDINGS.

TUESDAY, JUNE 7TH, 1870.—MORNING MEETING.
The Chair to be taken at Eleven o'clock.

Inaugural Address by the President; Admission of new Members; Reading of Papers and Communications.

EVENING MEETING.
The Chair to be taken at Seven p.m.

Lecture by Messrs. T. N. Kirkham, C.E., and W. Sugg, A.I.C.E., on "Photometry as applied to the Estimation of the Value of Coal Gases."

WEDNESDAY, JUNE 8TH, 1870.
The Chair to be taken at Eleven a.m.

Reading of Papers and Communications. Election of Officers for ensuing year, &c.
At 8ix p.m. the Members and Friends will dine together at the Freemasons Tavern, Great Queen Street. Tickets for the Dinner, 7s. 6d. each, may be had from the Secretary.

THURSDAY, JUNE 9TH, 1870.

Visit of the Members to the Chartered Gas Company's New Works at Beckton.

List of Papers and Communications to be submitted to the Meeting.

Notice of Motion by Mr. W. J. WARNER:—
"That a Gas Managers Benefit Fund be formed for the relief of deserving members who may be incapacitated by old age or sickness from discharging their duties; and that a sub-Committee, consisting of the President, ex-President, and President for the coming year, be appointed to consider the best means of giving effect thereto, and to report to the next Annual Meeting upon the formation of such fund."

"On Setting and Working Retorts." By Mr. E. S. CATHELS, Crystal Palace District Gas-Works, Lower Sydenham.
"Twelve Months' additional Experience in Charging and Discharging Retorts by Machinery." By Mr. J. SOMERVILLE, Dublin.
"On Sunday Labour." By Mr. ROBERT MORTON, London.
"The Application of Gas to the Generation of Steam." By Mr. E. GODDARD, Ipswich.
"Remarks on Photometry." By Mr. F. W. HARTLEY, London.
"On Scrubbers." By Mr. GEORGE T. LIVESEY, London.
"The Manufacture of Tar Pavement." By Mr. T. H. METHVEN, Bury St. Edmunds.
"On Stoppage in Ascension-Pipes." By Mr. D. CLARK, Brymbo.
"On Gas-Meters." By Mr. W. J. WARNER, South Shields.
"On the Method of Testing the Illuminating Power of Gas, with special Reference to Burners." By Mr. CHARLES HEISCH, F.C.S., Gas-Examiner to the Corporation of London.
"On Artificial Alizarine." By Mr. W. T. FEWTRELL, F.C.S., London.
"On a New Form of Gas-Exhauster." By Mr. E. WHITE, Birmingham.

WILLIAM H. BENNETT, Hon. Sec.

May 17, 1870.

42, *Parliament Street,*
London, May 17, 1870.

Dear Sir,—It is with sincere regret I have to announce to you that the illness of our much-respected President will prevent him from attending the Annual Meeting. It has been arranged, however, that Mr. Ohren, one of the Vice-Presidents, shall occupy the chair.
You will recollect that at the Annual Assembly last year the time appointed for the coming meeting was the 31st of May; but, in consequence of the Jockey Club having gone out of its usual course by fixing the Derby Day for the 1st of June, and the difficulty members would therefore experience in finding hotel accommodation in London during that week, the Committee have determined to hold a *pro formâ* meeting on the 31st of May, and adjourn till the following Tuesday. The business of the meeting, therefore, will commence on Tuesday, the 7th of June, and be continued on the following days.
I beg also to call your attention to the subscription for the current year, which is now due, and I shall be happy to receive the same by Post-Office Order, payable in Parliament Street.
A balloting paper, together with card of admission to the meeting, will be sent to you in the course of a few days.
I am, dear Sir, yours truly,
WILLIAM H. BENNETT, Hon. Sec.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.
Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 42, Parliament Street, WESTMINSTER. [Office of the JOURNAL OF GAS LIGHTING, &c.]

T. EVANS & SONS, Retort-Setters and GAS-OVEN BUILDERS, having done the work at various Gas-Works in England and Wales for many years, can be well recommended. Testimonials and references on application.
Communications to be addressed to the Gas-Works, Cannock, near STAFFORD.

TO BE SOLD CHEAP, a second-hand PURIFIER, 10 ft. by 5 ft., and 3 ft. 6 in. deep, with 4-in. connexions and sieves, all complete and in good condition.
Apply to HENRY WEBB, Manager, Gas-Works, EVESHAM.

FOR SALE, Two Purifiers, 3 ft. 6 in. square by 2 ft. 9 in. deep, with Clayton's six-way centre-valve.
Apply to CLAYTON, SON, AND CO., Gas Engineers and Contractors, Hunslet, LEEDS.

FOR SALE, a Station-Meter, case 8½ ft. square; also connexions and valves. Taken down to make way for a larger meter.
Apply at the EDINBURGH Gas-Works, NEW STREET.

FOR SALE, Five Cast-Iron Guide Columns and Girders.
Five Grooved Wheels in sliding carriages. The columns are 26 ft. long, 12 in. diameter at the base, and 10 in. at the top.
The Wrought-Iron Framing for a 40-ft. Gasholder.
Centre-Valve for Four Purifiers, with 6-in. connexions.
Address MANAGER, Gas-Works, NEWBURY.

TO CONTRACTORS.

THE Directors of the Newark Gas Company are prepared to receive TENDERS for the construction of a GASHOLDER-TANK to be erected at their works at Newark.
Drawings and specifications may be inspected, and forms of tender and schedules of quantities may be obtained (on payment of the sum of Ten Shillings), at the Offices of the Company, at Newark, and at the Office of Messrs. Thomas and Charles Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Monday, the 16th day of May inst., and tenders must be delivered at the Offices of the Company on or before Wednesday, the 15th day of June next.
The Company do not pledge themselves to accept the lowest or other tender.—By order,
C. C. FOOTTIT, Clerk to the Company.
Newark, May 12, 1870.

TO GASHOLDER MAKERS.

THE Blackpool Local Board are open to receive TENDERS for the manufacture and erection of a new GASHOLDER, 80 ft. diameter by 20 ft. deep, with columns, girders, and valves complete. The tenders to be accompanied by drawings and specification of the form, sizes, and weights of the materials, and to state time required to have it ready for work (time being of great importance).
Sealed tenders, to be addressed to the Chairman of the Gas Committee, endorsed "Tender for Gasholder," before the 30th day of May.
The Board do not bind themselves to accept the lowest or any tender, and particulars may be known, and information obtained from the undersigned,
JOHN CREW, Manager.
Gas-Works, Blackpool, May 20, 1870.

WATFORD GAS & COKE COMPANY.

TO BUILDERS, CONTRACTORS, & OTHERS.

THE Directors of the above Company are desirous of receiving TENDERS for the construction at their works of a BRICK TANK, 63 ft. in diameter and 18 ft. deep, for a new gasholder.
Plans and specifications may be seen at the Company's Works, Bushey, near Watford, Herts, and a form of tender (which must be strictly adhered to) will be supplied on application to William Rowell, Solicitor, Rickmansworth, to whom sealed tenders are to be sent on or before the 4th day of June, 1870.—By order of the Board.
WILLIAM ROWELL, Secretary.

TO IRONFOUNDERS AND CONTRACTORS.

THE Directors of the Rochester, Chatham, and Strood Gaslight Company are prepared to receive TENDERS for the supply and erection of Four Purifiers, 20 ft. by 16 ft., with centre-valve and connexions, lifting apparatus, &c., and Three Scrubbers, 10 ft. by 15 ft., according to drawings and specifications which may be seen, during Office hours, on any day after Friday, the 3rd of June next, at their Office, 56, High Street, ROCHESTER.
By order,
W. SYMS, Secretary.

THE MALTA & MEDITERRANEAN GAS COMPANY, LIMITED.
NOTICE is hereby given that the ORDINARY GENERAL MEETING of the SHAREHOLDERS of this Company will be held at the London Tavern, Bishopsgate Street, on TUESDAY, the 7th of June next, at Twelve o'clock precisely.
At this Meeting will be presented the report of the Directors (containing their recommendation of a Dividend), and the Accounts of the Company for the twelve months ended the 31st of March last.
The Directors retiring are Robinson Duckworth, Esq., and John Romanes, Esq., who are eligible for re-election.
The Transfer Books will be closed from the 1st to the 7th of June inclusive.
By order,
E. P. ROWSELL, Secretary.
60, Gracechurch Street, May 23, 1870.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.
HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, E.C., and 138, Regent Street, LONDON.
Agents wanted.

Now ready, in roan tuck, gilt edges, price 6s., postage 4d.,

WEALE'S ENGINEER'S, ARCHITECT'S, AND CONTRACTOR'S POCKET-BOOK for 1870.

Containing a vast mass of useful Rules, Tables, Formulæ, &c., &c., with 8 copper plates, and numerous wood-cuts.

"A necessary and reliable book of reference. Every branch of engineering is treated of, and facts, figures, and data of every kind abound."—*Mechanics' Magazine.*

"It contains some valuable information to managers of gas-works, more especially a gas engineer's calendar, with tables for calculating the periods of lighting and extinguishing public lamps."—*Journal of Gas Lighting.*

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This book is replete with information, and prices of many well-known as well as perfectly new inventions, interesting to all in the mechanical trades, as well as corporations, governments, gas managers, private gentlemen, and shopkeepers.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICK.

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ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 20 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

CHARLES HORSLEY, Agent.

OXIDE OF IRON.—We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.
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MANUFACTURERS OF
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Large Pattern-Books complete, with Book of Prices, 7s. 6d.

NAPHTHALINE
IN GASHOLDER INLET-PIPES.

With Livesey's Patent Man-Lid these Pipes can be examined and cleansed without loss of Gas, with the greatest facility and without any risk.

Cost of the Apparatus, to cover two 18-in. pipes, about £10.

Royalty: At the rate of 1s. per foot diameter of each Gasholder, and no further payment.

LIVESEY'S SYSTEM OF WATER-VALVES
FOR PURIFIERS

Will effectually prevent that contamination of the pure Gas which so frequently occurs where the ordinary Valves are used. They are much less costly, easily applied, and, being simple castings, cannot well get out of order, while by their use it is found that the Gas will bear a continuous test for Sulphuretted Hydrogen for an indefinite time.

Application to be made to the Patentee, GEORGE LIVESEY, Engineer, South Metropolitan Gas-Works, S.E., where both inventions are in use.

W. J. SIMMONDS,
Retort and Boiler Setter and Contractor for Gas-Works in general,
7R, SOUTH STREET, NEW NORTH ROAD, ISLINGTON, LONDON, N.

Upwards of 16 years Retort Setter to the Chartered Gas Company, Brick Lane and Curtain Road Stations.

Materials supplied on reasonable terms if required, or labour only.

No connexion with any other Retort Setter.

N.B.—Orders to be addressed as above.

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J. H. ROBINSON & CO.,
ENAMELLERS, DIAL AND TABLET MANUFACTURERS,
THE MERSEY WORKS,
347, GRAFTON STREET, TOXTETH PARK, LIVERPOOL.

Manufacturers of all descriptions of Gas and Water Meter, Clock, Timepiece, Tell-Tale, and Log Dials, Lettered Addresses, Number Plates, Gauges, Scales, &c,

ROBERT MACLAREN and CO.,
EGLINTON FOUNDRY, GLASGOW,
Manufacturers of all sizes of Cast-Iron Main-Pipes by an improved Patent, General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

ADDISON POTTER,
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NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of Clay Retorts, Fire-Bricks, and every description of Fire-Clay Goods.

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MICA CUT TO ALL SIZES

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FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
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DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
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WOOD SIEVES FOR PURIFIERS.

These justly celebrated Sieves, with bevel bars and hard-wood side frames, have been extensively made by Messrs. Walker for over seven years, and their advantages and durability are fully established. Messrs. Walker make them in very large quantities, having mills and machinery specially laid out for them, producing them at the most moderate cost.

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TWENTY YEARS PRACTICAL EXPERIENCE.

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Fire-Clay and Iron Retorts, Double and Single Grooved Brick Retorts, of every description.

Bentley's Improved D Brick Segment Retorts, 5 or 3 in one bed.

Testimonials and references on application.

TO GAS-WORK MANAGERS.

THE Advertiser having erected works for the supply of part of the city of Buenos Ayres with gas from rough tallow, has been requested to recommend a suitable person as WORKING MANAGER. The salary will be about £20 per month. Applicants must state age and experience, and give references to GEO. BOWER, St. Neots, HUNTS.

N.B.—Copies only of testimonials to be sent, and the Advertiser does not undertake to return them, or to answer all applications.

CATHELS & TERRACE'S

PATENT FOUR-WAY DISC GAS-VALVE

(Being a simplification and improvement of Cathels's well-known Valve) is the best Valve for Gas-Works. It is specially applicable as a by-pass to Condenser, Exhauster, Scrubber, Station-Meter, &c., as, having no springs, ground faces, or other delicate complications to be affected by crude gas, it NEVER SETS FAST. When applied to Purifiers, the utmost facility of change is afforded; the direction of the flow of the gas is seen at a glance, and no unpurified gas can pass into the holders at each change, as happens with Centre-Valves. In either application ONE VALVE SERVES AS THREE OTHER VALVES. The opening and closing are now effected by one movement, and the ports being all on the same level, enables the connexions to be simple lines of straight piping. The closing of one gas-way opens another, preventing the possibility of accidentally stopping back the gas. The Valve has been in general use for upwards of five years, with the most satisfactory results, and is so simple and strong that it may be considered indestructible.

Illustrated Circular, Prices, &c., on application to the Makers,

Messrs. GUEST & CHRIMES,
FOUNDRY AND GENERAL BRASS-WORKS,
ROTHERHAM.

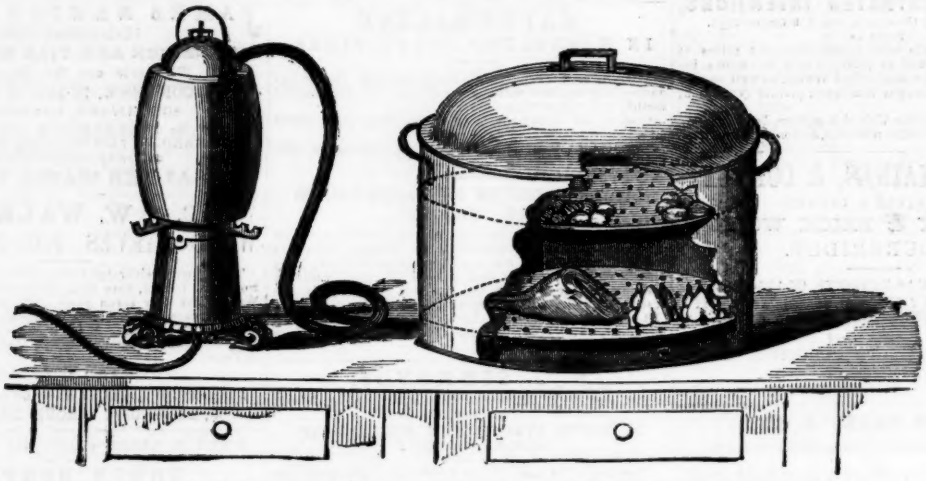
LIVESEY FIRE-CLAY WORKS,
NEAR BLACKBURN, LANCASHIRE.
ORLANDO BROTHERS,
MANUFACTURER OF PATENT CLAY RETORTS,
AND EVERY DESCRIPTION OF
TUBULAR GLAZED SEWERAGE PIPES, BENDS, JUNCTIONS, ETC.
FIRE-BRICKS, TILES, BLOCKS, AND CHIMNEY-TOPS.

JOHN WRIGHT & CO.,

30, BROAD STREET, ISLINGTON, BIRMINGHAM.

WRIGHT'S IMPROVED STEAMER,

Heated by a small Gas-Burner.



The above drawing represents a most effective, economical, and cleanly mode of cooking during the summer months.
By it two or three joints, several puddings, and three or four kinds of vegetables can be cooked by one small Burner.
The Boiler holds 5 gallons, and is heated to boiling-point under an hour.
By means of a Tube the steam is conveyed to the cooking vessel, which may be placed in another apartment from the Stove.
The advantages of cooking by steam over boiling are manifold; amongst others, three or four joints may be put into the steam vessel and cooked without tasting one of the other. While meat *boiled* loses weight and becomes sodden, if steamed it gains in weight—the difference being from 6 to 10 per cent. Again, the liquor that remains in the Steamer makes good broth with the addition of a few herbs.
Again, no pudding requires to be put into a bag, but simply laid in the Steamer, or if light put into a basin. In fact, the advantages can never be realized by any one unacquainted with this mode of cooking.
But it is evident that as the Gas and Boiler can be in a back kitchen or scullery, while the Steamer is in the kitchen, cooking can be going on without the unpleasantness of a heated kitchen in the summer.

Price, complete with Gas Stove, Boiler, and Steamer, with Steam-tight Nozzles, £4 10s.

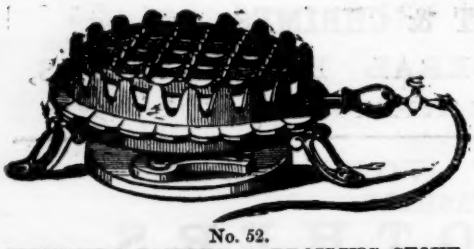
No. 28.

WRIGHT'S
IMPROVED GAS COOKER,

For BOILING, BROILING, and TOASTING.

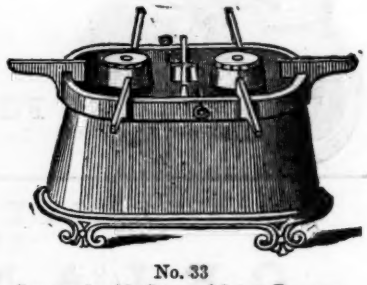
Price 45s.

This Stove effectually and economically boils three or four saucepans, and cooks (by reflection) chops, steaks, a small joint, or pair of fowls.
It also makes toast, and acts very nicely as a salamander.
As the heat can be regulated to the greatest nicety, it is highly recommended for making preserves, stews, or anything requiring gentle boiling.
It is a most useful apparatus in any kitchen, and in large establishments will be found a very valuable auxiliary.



No. 52.
IMPROVED BOILING & BROILING STOVE.
This is a very powerful Stove, with Atmospheric Burner; will broil under and boil above at the same time.
Price 15s.

No. 102.
This is a very effective Stove, with brass Burner.
Price 4s. 6d.



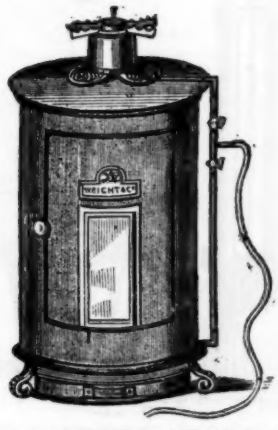
No. 33
Is a serviceable Stove with two Burners.
Price 10s. 6d.
12 feet prepared Tube for ditto, 4s.
Cock and Nozzle for ditto, 1s. 6d.

32½ per cent. Discount to the Trade.

JOHN WRIGHT & CO.,

30, BROAD STREET, ISLINGTON, BIRMINGHAM.

WRIGHT'S IMPROVED GAS COOKING STOVES.



SQUARE COOKING STOVE, No. 65,

With Cast-Iron Top and Bottom, Door, and Frame.

14 in. square, with small Boiling Stove on top	£3 10 0
16 in. square, with one large Boiling and Broiling Stove on top	4 5 0
18 in. square, with two small Boiling Stoves, and one large Boiling and Broiling Stove on top (as drawing)	5 5 0
24 in. square, with 2 folding doors; 2 small Boiling Stoves, and one large Boiling and Broiling Stove on top	7 10 0

ROUND COOKING STOVE, No. 68,

With Cast-Iron Top and Bottom, and Glass Door.

11 in. diameter	£1 15 0
14 in. diameter	2 2 0
16 in. diameter	2 12 6
18 in. diameter	3 3 0

All the Boiling and Broiling Stoves are Atmospheric.

For Roasting, Broiling, Frying, Baking, Boiling, Stewing, or Preserving, either together or separately.

The advantages of Gas Cooking are—Its portability and cleanliness; perfect and immediate control over the heat; it requires but little attention; there is no roasting or baking fire to make up; it is always ready; it keeps the kitchen and house cool; it is economical even where gas is dear, and it is only alight while actually in use.

WRIGHT'S IMPROVED STOVE,

With Atmospheric Burner, for Heating Tailors' Irons.

Price: For 1 Iron, 15s.; 2 Irons, 20s.; 3 Irons, 25s.; 4 Irons, 30s.

WRIGHT'S IMPROVED IRONING STOVE.

Will heat 3 Flat Irons at one time. It is also well adapted for Hatters' Irons. Price 10s. 6d.

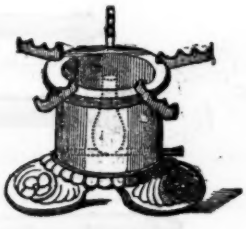
12 ft. of prepared Tube for ditto, 4s. Cock and Nozzle for ditto, 1s. 6d.

No. 55.

Same Stove as Nos. 35 and 45, but larger.

Price 7s. 6d.

12 feet prepared Tube for ditto, 4s.
Cock and Nozzle for ditto, 1s. 6d.



No. 36,

With Gauze Wire.

Price 2s.

No. 35.

Price 3s. 6d.

No. 45.

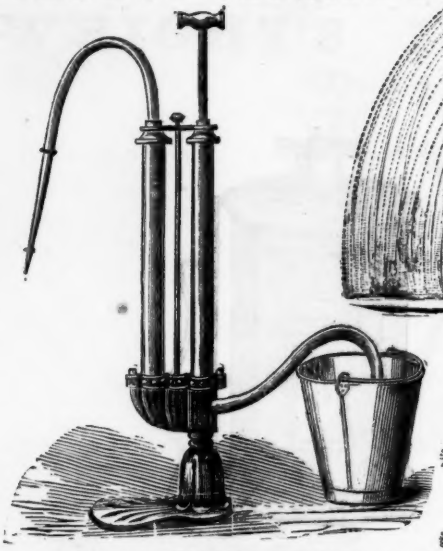
Same Stove as No. 35, but larger and stronger. **Price 5s. 6d.**

12 feet prepared Tube for ditto, 4s.
Cock and Nozzle for ditto, 1s. 6d.

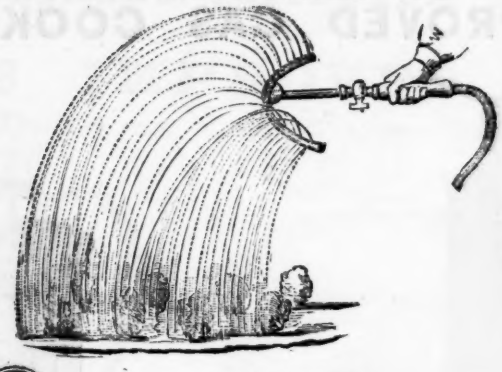
32½ per cent. Discount to the Trade.

JOHN WRIGHT & CO.,

30, BROAD STREET, ISLINGTON, BIRMINGHAM.



IMPROVED GARDEN PUMP.
Price 30s. each.



WRIGHT'S
PATENT LEAMINGTON SHOWER.

Waters 6 feet at a time most effectually.

¾ in.—Price, with 1 24-in. straight and 1 14-in. circular head, 15s.

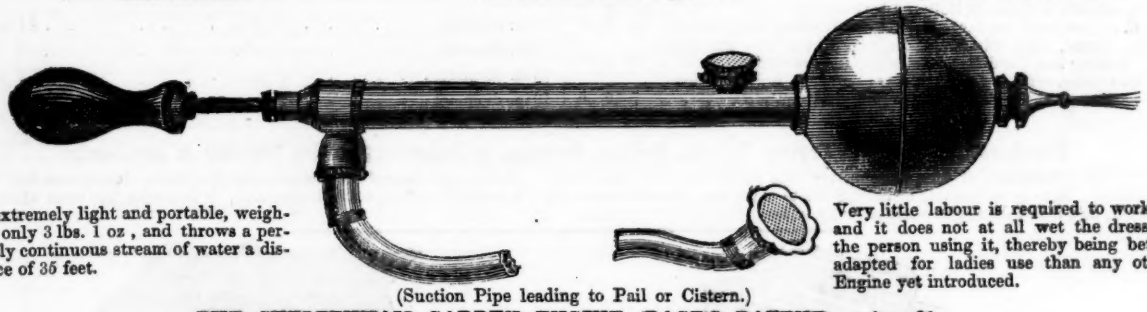
With 1 circular head only, 10s. 6d.

⅝ in.—Price, with 1 18-in. straight and 1 12-in. circular head, 12s.

With 1 circular head only, 7s. 6d.

BRASS
SPRING SPREADER.
No. 15.
½ in., 1s. 6d.; ⅝ in., 1s. 9d.; ¾ in., 2s. 6d.

WRIGHT'S IMPROVED HYDRONETTE.
No. 1, 12s. 6d.; No. 2, 15s.; No. 3, 20s.; No. 4, 25s.; No. 5, 30s. each.



Is extremely light and portable, weighing only 3 lbs. 1 oz, and throws a perfectly continuous stream of water a distance of 35 feet.

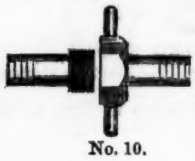
Very little labour is required to work it, and it does not at all wet the dress of the person using it, thereby being better adapted for ladies use than any other Engine yet introduced.

(Suction Pipe leading to Pail or Cistern.)

THE CHELTENHAM GARDEN ENGINE (PAGE'S PATENT), price 21s.

No. 2—BRASS UNION BRANCH.
½ in. × 11 in., 3s. 9d.; ⅝ in. × 16 in., 5s.; ¾ in. × 16 in., 6s.; ⅞ in. × 16 in., 9s.

No. 1—BRASS SINGLE BRANCH.
½ in., 2s. 3d.; ⅝ in., 3s. 3d.; ¾ in., 4s. 9d.

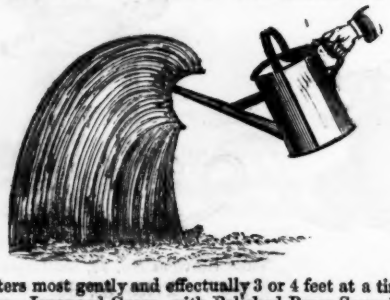


No. 10.

BRASS
UNION JOINT.

½ in., 1s.; ⅝ in., 1s. 2d.
¾ in., 1s. 6d.; ⅞ in., 2s. 6d.

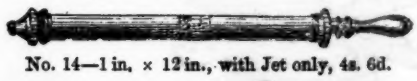
WRIGHT'S
IMPROVED SHOWER WATERING-POT.



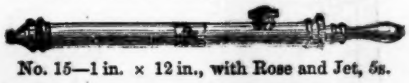
Waters most gently and effectually 3 or 4 feet at a time.
Price—Japanned Green, with Polished Brass Spreader,
6 quart, 8s.; 8 quart, 10s. 6d.; 12 quart, 12s.

IMPROVED GARDEN SYRINGES.

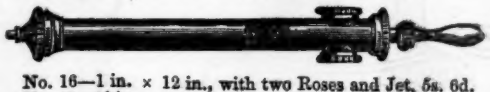
No. 11—1 in. × 12 in., with Rose and Jet, 4s. 6d.
No. 12—1¼ in. × 14 in., „ „ 6s. 6d.
No. 13—1½ in. × 16 in., „ „ 8s.



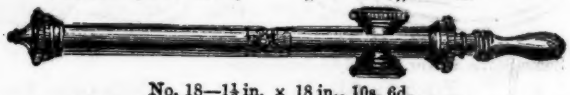
No. 14—1 in. × 12 in., with Jet only, 4s. 6d.



No. 15—1 in. × 12 in., with Rose and Jet, 5s.



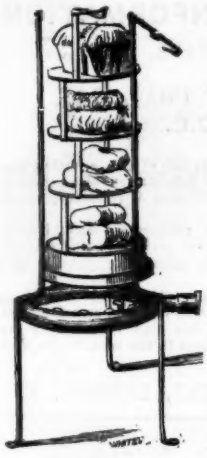
No. 16—1 in. × 12 in., with two Roses and Jet, 5s. 6d.
No. 17—1¼ in. × 16 in., „ „ 8s.



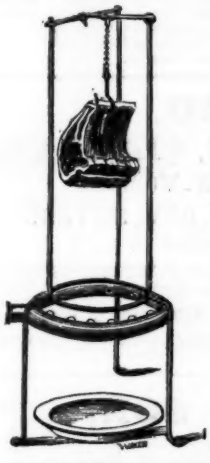
No. 18—1½ in. × 18 in., 10s. 6d.
No. 19—1½ in. × 18 in., with Ball Valve, 12s. 6d.
N.B.—These are recommended as the strongest and best Syringes that are made.

32½ per cent. Discount to the Trade.

S. LEONI, ADAMAS WORKS, ST. PAUL STREET, NEW NORTH ROAD, LONDON, N.



A joint of 6 lbs. roasted in 1 hour—consumption of gas 20 feet—cost one penny (at 4s. per 1000); 10 lbs., 1½ hour; 15 lbs., 2 hours. Four quartern loaves of bread baked in 1 hour.



A joint or fowl, chops, steaks, or fish, may be roasted or grilled under the gas-ring whilst the apparatus itself is in use for baking. First size is adapted for roasting joints, poultry, game, &c., up to 20 lbs. together, in about 2½ hours. One joint, one dish of potatoes roasted, and two pies baked in one hour at the expense of one pennyworth of gas.

FIRST-CLASS PRIZE MEDALS OF INTERNATIONAL EXHIBITIONS OF 1862 & 1867, & CORNWALL ROYAL POLYTECHNIC INSTITUTION, 1869.

Economizer. Scale 1-10th of full size.

China, with Coloured Designs

Economizer. Scale 1-10th of full size.

Portable Atmospheric Gas Heating Stove.

S. Leoni's Catalogue

LEONI'S PATENT STANDARD GAS BURNER.
One Shilling each. Triangles for Globes 6d. each.

LEONI'S PATENT ATMOSPHERIC GAS COOKING STOVES,
(Broiling and Roasting by Reflection only), from 15s. each.

LEONI'S PATENT ATMOSPHERIC GAS HEATING STOVES,
For Halls, Conservatories, Counting Houses, Rooms, Churches, &c. (most economical, no flue required), from £1 16s. each.

Leoni's Patent Atmospheric Open Gas Fires,
(Cheerful, brilliant, and most effective) with asbestos or clinkers), from £1 1s. each.

LEONI'S PATENT ATMOSPHERIC GAS APPARATUS.
With self-heating hot-water circulating boiler for green-houses and all buildings, (require no atttention, and are very economical).

LEONI'S PATENT ATMOSPHERIC GAS APPARATUS,
(No flue required) with copper circulating water boiler, and 5 ft. 6 in. bath, (36 gallons of water raised to a temperature of 100° F. in ½ hour with less than a pennyworth of Gas and without any smell), from £10 10s. complete.

LEONIS PATENT ATMOSPHERIC GAS ROASTING & ALSO BAKING APPARATUS.
(In 1 hour's time with less than 1 pennyworth of Gas 6 lbs. of meat are well roasted, or 16 lbs. of bread baked, also one joint roasted, one dish of potatoes roasted, and 2 pies baked, all together in one hour), from £5 5s. each complete.

Leoni's Patent Gas Baking, & also Roasting Ovens,
Portable for stationary, or families, restaurants, hotels, clubs, hospitals, and establishments of the largest kind.

Leoni's Patent Atmospheric GAS RANGES,
Complete. Portable or stationary, for families, hotels, &c.

IMPROVED PATENT ADAMAS GAS BURNERS,
(Approved and highly commended by the official Gas Referees, *Vide* "Report," obtained Prize Medals in 1862 and 1867), from 1d. each.

LEONI'S IMPROVED PATENT ADAMAS TAPS
For Beer, Wine, Acid, &c., never corrode or leak, turn always easy and smooth, and are constantly clean and sweet, from 1s. 3d. each.

£5 5s. complete.

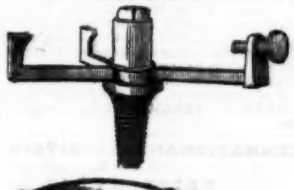
Chops and steaks, or two fowls, or a joint roasted on gridiron, and, at the same time, soles, &c., fried on top of the reflector.

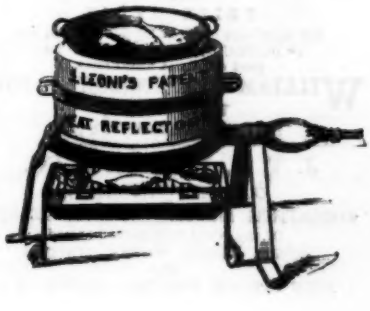
Gas consumers, once aware of the advantages of cooking by Gas, will be glad to meet with efficient apparatus, **and Gas Companies have every interest to make such apparatus known.**

AGENTS WANTED IN EVERY TOWN.

LIBERAL TERMS.

PATENT STANDARD BURNER.
Scale ½ size.





CANNEL COAL.—The West Yorkshire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Huggon, Esq., F.C.S.:

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton . . .	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz.—

Yield of gas	10,416 cubic feet.
Illuminating power	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas	10,080 cubic feet.
Illuminating power	14·41 sperm candles.
Yield of coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles.*

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

OLD WEMYSS CANNEL COAL.—Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to Mr. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS,
COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

THE
HUCKNALL COLLIERY COMPANY
Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

THOMAS EDINGTON & SONS,
PHŒNIX IRON-WORKS,
GLASGOW,
Manufacturers of all kinds of
GAS AND WATER PIPES,
Branches, Bends, Water-Traps, Tank-Plates, Valves, and general Castings. Also
RAILWAY CHAIRS & SLEEPERS,
AND
GRIFFIN'S PATENT PERMANENT WAY.
London Office, 63, Old Broad Street.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST IRON GIRDERS.
DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.

FIRE-CLAY GAS-RETORTS, &c., CANNEL AND STEAM COALS.

WILLIAM FRASER, Inverkeithing (owner of the Works at which Fire-Clay Retorts were first made), having greatly enlarged his Works, can supply Retorts and other Fire-Clay Goods to any extent.

References can be given to managers of above a hundred Gas-Works whom he supplies.

WILLIAM FRASER ships COWDENBEATH PARROT COALS at Charlestown and Burntisland at 12s. per ton; and HALBEATH STEAM COALS, on Navy List, at 8s. 6d. per ton.

INTERNATIONAL EXHIBITION, 1862.
CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for
good quality of Fire-Bricks.
WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

J. T. B. PORTER & CO.,
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR GAS-WORKS
Of any extent at Home and Abroad,
GOWTS BRIDGE WORKS, LINCOLN,
AND
JOHN STREET, ADELPHI, LONDON, W.C.

Just Published, demy 8vo, half bound roan, cloth sides, lettered, price 7s. 6d., by post 8s.,

THE GAS MANAGER'S HANDBOOK,

CONSISTING OF

TABLES, RULES, AND USEFUL INFORMATION

FOR

GAS ENGINEERS, MANAGERS,

AND OTHERS ENGAGED IN THE

MANUFACTURE AND DISTRIBUTION OF COAL GAS.

By THOMAS NEWBIGGING, A.I.C.E.

"An extremely useful compilation has been made by Mr. T. Newbigging, late of Bacup, under the title of 'The Gas Manager's Handbook.' It contains an immense amount of information, of a practical character, on all matters which concern gas managers, and forms an admirable work of reference, which will no doubt find a place in every gas office."—*Journal of Gas Lighting.*

"Within the moderate compass of about 160 pages, the author—or perhaps we should more appropriately say the editor of this Handbook has contrived to pack, without crowding—and without confusion or ambiguity, almost all the information which any gas engineer or manager could desire in a book of reference such as this professes to be."—*Colliery Guardian.*

"This volume is an exhaustive cyclopædia of the literature of gas lighting. The author has laid his hands on everything good that already existed, in the way of tables and statistics, and has embodied the whole, with many additions, in the form of a volume, the want of which has been long felt by gas engineers and managers. An interesting chronology of gas lighting is appended to the book."—*English Mechanic.*

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

ROBERT DEMPSTER,
Gas Engineer and Contractor, Rose Mount Foundry, Elland, near Halifax.

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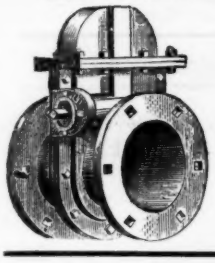

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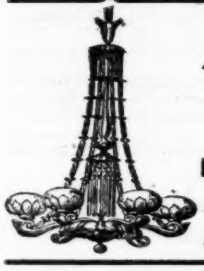

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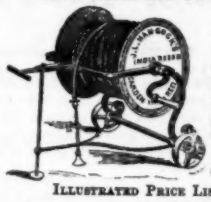

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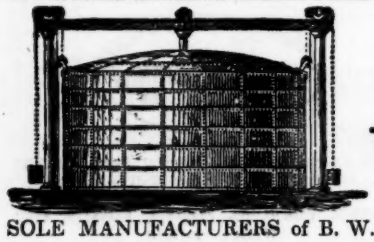

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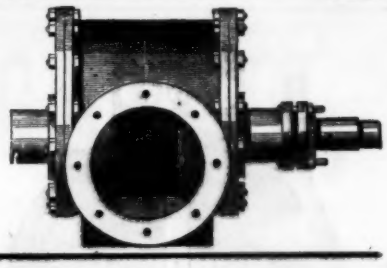
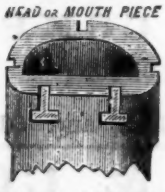


KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.



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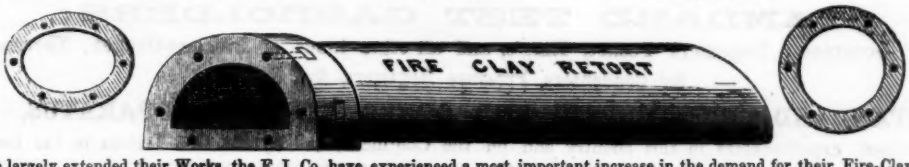

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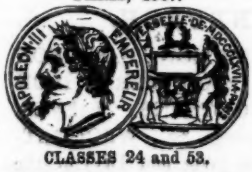

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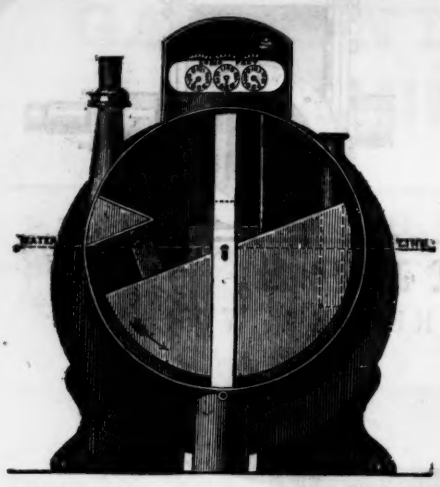

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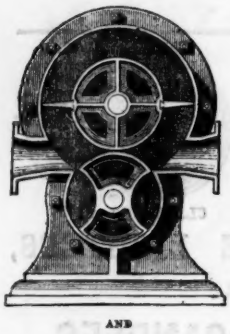

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